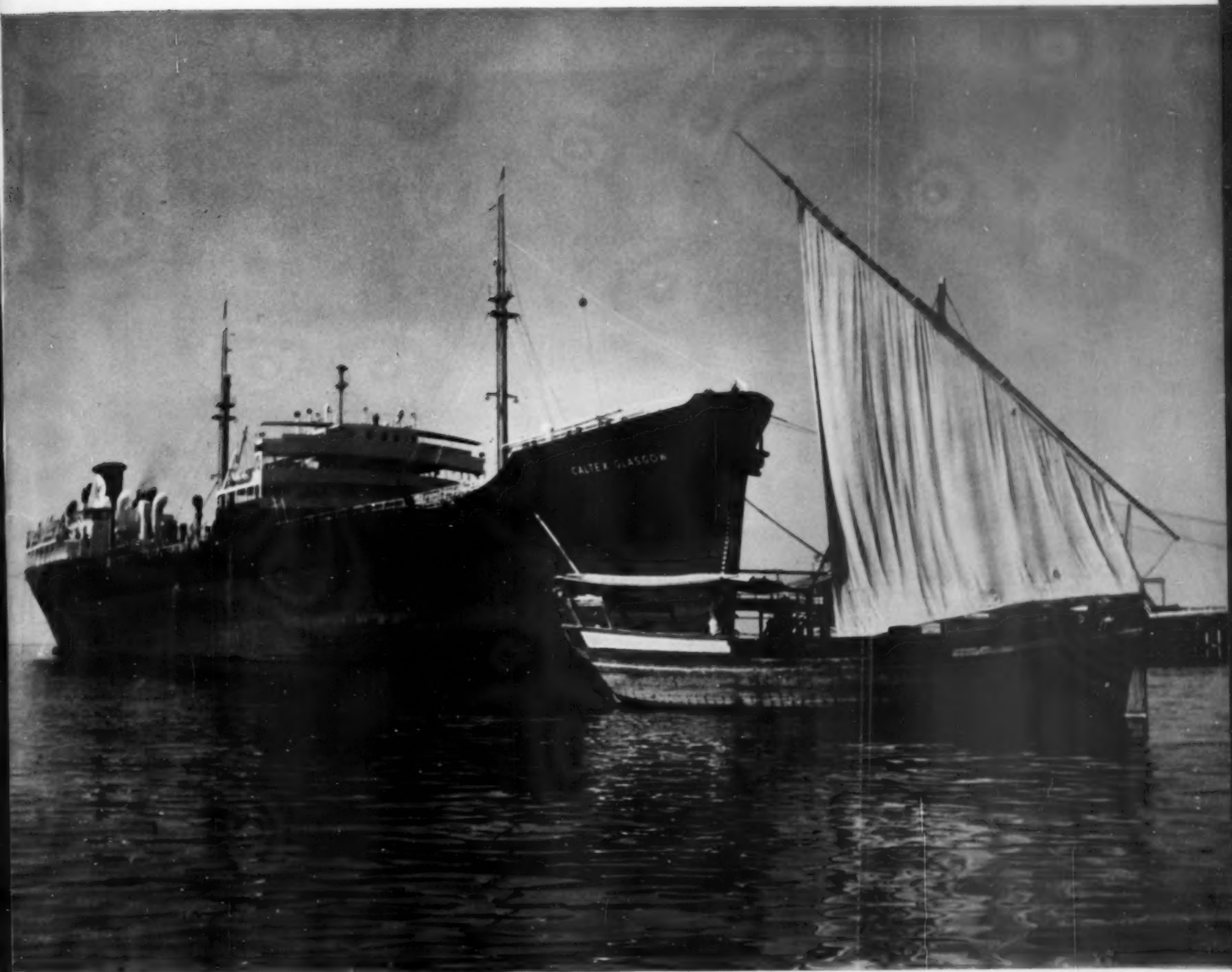
WORLD PETROLEUM

SEPTEMBER 1960



World proration and crude surplus — a symposium — page 40
Russian oil poses a problem — page 52

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table of contents page 3

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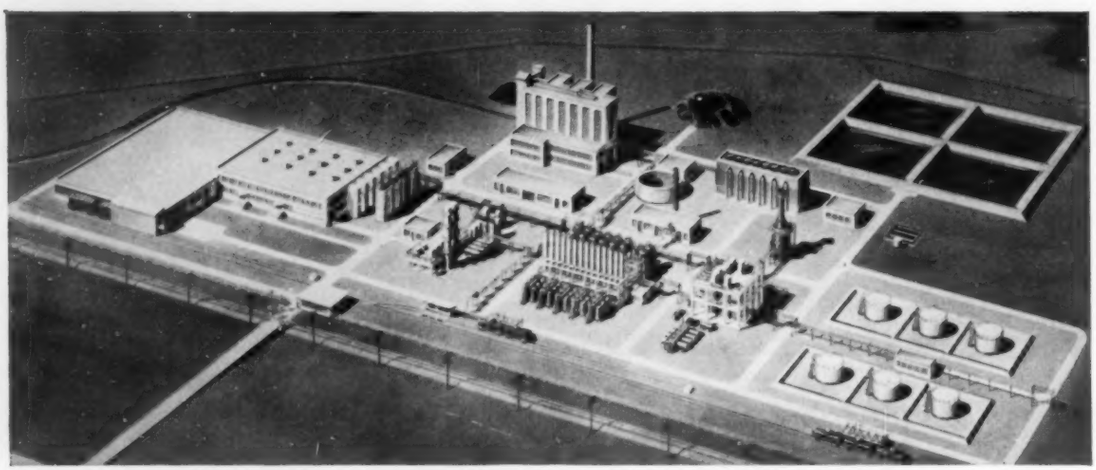

The Lummus Company has been awarded the contract to design, engineer and construct a 30,000 ton per year synthetic rubber plant near Bareilly, Uttar Pradesh, India for Synthetics and Chemicals, Ltd. This firm was recently formed by The Firestone Tire & Rubber Company in association with the banking and industrial firm of Kilachand Devchand and Company Private, Ltd. of Bombay.

The 30 million dollar project will include plants for the production of butadiene and styrene, the principal raw materials, as well as a copolymer plant to manufacture the final product, synthetic rubber. In addition, Lummus will construct all the plant utilities and offsites. Although Lummus will design the plant for a capacity of 30,000 tons or more per year, the initial annual production will be 20,000 tons. Technical divisions of The Firestone Tire & Rubber Company are furnishing the basic engineering and know-how for the butadiene, styrene and copolymer units.

The plant site has been established in the heart of the sugar cane and alcohol producing area, and the alcohol obtained from the sugar cane will be the source of the butadiene, the principal ingredient of synthetic rubber.

Indian technicians and operating personnel will be trained to run the plant, whose final products will meet standard world-wide industry specifications.

Financing of the project will be assisted by a 27,100,000 Indian rupee (or $5,700,000) loan from the Export-Import Bank of Washington to Synthetics and Chemicals, Ltd. This constitutes the largest foreign currency loan in the bank's history. The remainder of the financing will come from private banks in the United States and the United Kingdom as well as from India.

The project is expected to save India approximately 10 million dollars in foreign exchange annually.

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World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

CONTENTS

4 Washington Pipeline, *by Joseph B. Huttlinger*

8 London Letter, *by Cecil W. Wood*

14 Canadian Notes

39 Editorial—A Step Towards Price Stability

40 Oil's Outlook in an Era of Plenty

45 World Oil Demand in 1960 Will Be Nearly 22 Million Barrels Daily

48 World's Wildcats Reviewed

52 Russian Oil Competition

54 Exploratory Techniques Today in the Athabasca Sands Area, *by William B. Gallup*

64 Pemex Progress in Mexico

72 Petrochemical Raw Materials for Epoxy Resins, *by Peter W. Sherwood*

80 Artistic Design Produces Good Process Performance, *by Wheaton W. Kraft*

86 Getting on Target with Overseas Estimates, *by William I. McKay*

90 Processing Review, *by William C. Uhl*

94 International News and Notes

108 Oil Company Staff Changes

112 Kuwait Oil Completes New Injection Plant

118 World Petroleum Statistics, December 1959

138 Advertisers' Index

THIS MONTH'S COVER

The old and the new. A Caltex tanker and a Persian Gulf coastal fishing vessel in port at Bahrain. Photograph is by John D. E. Baker, head of the film section of Bahrain Petroleum Co. He served in the Royal Air Force as a medical photographer and after the war opened his own studio in London. He is a member of the Royal Photographic Society and the Institute of British Photographers.

Washington Pipeline

by Joseph B. Huttlinger

Depletion Study Next Year

Foes of the depletion allowance for crude-oil and natural-gas production want a full-scale study of the tax provision next year. Although foes in the Senate now add up to a record of 36 members either voting for a cut or on record for one, all of them admit there is no chance this year of action to change the present rate of 27.5%. Instead, one after the other of those going after the provision have suggested the matter be set down for full and searching study by tax-writing committees of the Senate and House. Whether this will be done remains to be seen.

In order to suggest areas for study, Senator Albert Gore (D., Tenn.), one of the foes, proposed two other ways to haul down the benefits of the tax provision for oil and gas operators. He offered, and then withdrew, amendments which would: (1) Limit depletion at the present rate to 33-1/3% of taxable income, instead of 50%, the present law. (2) Limit depletion in any year to the cost of a property and over the life of a property to 10 times the cost.

The recess of Congress until August is held likely to help the foes of depletion. Senator John J. Williams, (R., Del.), one of their leaders, said "it won't hurt our chances, and it may make them a good deal better." He said his proposals to whittle down the allowance stand a better chance when there is more time to debate them, as is possible in August.

Coal vs. Fuel Oil

The American coal industry feels it needs government help in the next few years if it is to sell enough coal to keep economically healthy. So, coal is in the midst of a spirited campaign to have the government keep residual fuel oil and natural gas out of some, at least, of its traditional markets. Coal is working in several directions at once. It is asking Congress to set up a study looking toward a national fuels policy. It urges the Department of the Interior to keep residual fuel oil imports down. At the Federal Power Commission, it is fighting the expansion of gas pipelines into industrial areas. Recently it got admitted to a gas rate case, for the first time, to fight "tilting" of gas rates to charge home owners more and industrial users less; now coal can file a court appeal from any FPC decision. And, it has just persuaded Congress to set up a new $2 million a year coal research program to work on "short-range" needs of coal for better mining, preparation, and utilization.

Coal men are proud of the "fabulous" job they have done in replacing the man with the machine in the coal mines. Anyone who tours a coal mine cannot fail to be impressed. Now, 5,000 and 6,000 tons of coal a day are cut underground, carried to the surface, washed and sized, and dumped into railroad cars—all untouched by human hands. This has kept prices to the same levels as 12 years ago, but coal still cannot compete with gas or residual oil which is sold at "byproduct" or "dump" prices, it says. So, it wants government help.

The ultimate dream of coal men, for coal-to-oil and coal-to-gas plants, appears as far away today as it was 10 years ago or more. Bureau of Mines officials say it just is not "economic," although technically possible.

A Senate committee, in approving the new coal research effort, explained it is "unlikely" there will be coal-to-oil and coal-to-gas plants in the near future. The cost of the facilities, it appears, are "so enormous" few coal companies, even pooled together, can finance them. The Senate committee added that the new research program is needed because virtually all the Bureau of Mines effort has been on such "long-range" projects.

Import Appeals

Once again, USA oil companies are asking the Oil Import Appeals Board for larger import quotas for crude oil and oil products for the latter half of this year. The new round of appeals has come in despite the fact that the OIAB has rejected virtually all petitions in the past quota periods. For instance, a total of 54 appeals was filed for new or larger import quotas for the first half of this year. They asked 350,000 b/d to 400,000 b/d more of oil imports. Two were granted, and 47 were denied. At this writing, five are still to be decided.

USA producers are complaining that the program doesn't cut back imports enough. A score or so representatives of domestic producers laid their case before Secretary of the Interior Fred A. Seaton late in the spring.

Perhaps to handle this situation, Secretary Seaton now has reached into the ranks of domestic producers for the current administrator of the program. He has named Lawrence J. O'Connor of Houston, Texas, a former director and vice president of the Independent Petroleum Assn. of America, to run the program. Now, if there are complaints, he can tell the USA producers: "It's your own boy who is calling the shots."

More Import Control

The Independent Refiners Assn. of America says it has adopted a larger budget for four purposes, including one to seek out and publicize monopolistic and anti-competitive practices in petroleum marketing which threaten them. The IRAA also decided to plug for control over oil imports, higher refinery margins, and joint action with independent producers of oil.

Oil Study Samples

National Bureau of Standards is ready to sell a set of 24 standard samples of metal-organic compounds useful in studying lubricating oils and other oils. The price is $6 per 5 gal of material. A certificate of analysis, plus directions, is included. The samples help measure the amount of metal in crankcase oils, for instance, which gives a measure of engine wear. Oils from diesel locomotives are studied by several railroads to warn of faulty bearings. The metal content of oils also is useful in oil refining and development of oil additives.

Remove Trade Barriers

L. F. McCollum, president of Continental Oil Co., Houston, Texas, asked the USA to urge foreign governments to remove barriers to USA goods. Chairman of the government's National Export Expansion Committee, Mr. McCollum asked this as he reported on a first-hand study of export trade in France, Germany, and Italy. He said USA businessmen can sell more goods abroad if they study the markets, use a hard-sell technique, and have government backing. He said some persons abroad say USA business firms are slow to answer letters, slow to send technical data, and quote f.o.b. prices, when the foreign businessman needs c.i.f. prices.

Petroleum refinery sales rose 2.5% in the first quarter of this year from a year earlier, say FTC and SEC. The total rose to $7,262,000,000 in the first quarter of this year from $7,091,000,000 in the first quarter of last year. Profit after taxes rose even more, by 4%, to $684 million from $658 million.

The figures are in line with a rise of 6% in sales by all manufacturing corporations to $85,699,000,000 and of 4% in after-tax profits to $3,991 million.

Investment Abroad

The dramatic growth in USA business investment in foreign countries will be spelled out in detail in a comprehensive report now in its final stages at the US Department of Commerce. This is the first survey of its kind since before World War II. A companion survey, on foreign holdings of USA business firms, is just getting started, and is to be published late this year or next.

USA firms, owned 25% or more by foreigners, gave details of the foreign holdings by July 15, under a mandatory reporting requirement. The survey will show the value of foreign holdings in USA businesses by country of the foreigner, the USA industry, the total assets, capital flow from abroad, capital obtained from the USA earnings, remittances of dividends, interest, and branch profits.

Revises Demand Forecast

US Bureau of Mines foresees a domestic demand for petroleum products of 9,796,000 b/d this year, about 3.7% ahead of last year. Kerosine demand is expected to rise 13% to 340,000 b/d, an increase made possible in part by the inclusion of commercial jet fuel, formerly with "all other," under kerosine, starting this year. Distillate fuel oil is expected to rise 3.9%, to 1,880,000 b/d; gasoline by 2.9%, to 4,183,000 b/d; residual oil by 2.5%, to 1,586,000 b/d; and "all other" by 4.6%, to 1,807,000 b/d.

Exports of products are estimated at 7,000 b/d no change; and of products down 4.4%, to 195,000 b/d.

Imports of crude are estimated to rise 2% to 984,000 b/d, largely due to the Canadian exemption from the import program; while product imports are estimated at 795,000 b/d, down 2.5%.

USA crude-oil production is estimated at 7,158,000 b/d, a gain of 1.5%, and output of natural-gas liquids is put at 921,000 b/d, up 4.8%.

Compacts Hurt Gasoline

The U.S. is expected to be using more gasoline year by year, but the trend toward the compact automobile is regarded as slowing the rise. U.S. Bureau of Public Roads now estimates that for each 10% of standard autos replaced by compact cars, there is likely to be a reduction in the highway trust fund, largely supported by the gasoline tax, of 1.5-2%.

Import Exchanges Continue

The exchange of imported crude and unfinished oils for domestic continues at a brisk pace. This phase of the import program, once bitterly attacked by historic importers, now seems to be a part of the program to stay. A total of 66 exchange agreements for the last half of this year were made public by the Oil Import Administration one month after the start of the period. They cover 123,560 b/d of crude and unfinished oils imports.

OIA officials say exchanges the last half of this year will average 375,920 b/d in 150 separate agreements.

Under the rules, an import quota may not be sold for dollars. The person with a quota must bring in the oil himself. Once it is in the country, he may exchange it for domestic oil. Thus, inland refiners usually find it better to swap the imported oil at the coast and take domestic crude in return. This makes it unnecessary for them to pay expensive transportation.

One of the biggest exchange agreements recently made public was between Richfield Oil Corp. and Standard Oil Co. (Calif.). Under it, Richfield is importing 1,621,000 barrels of Saudi Arabian or Sumatran crude and turning it over to Standard in return for 1,977,620 barrels of California coastal crude.

What price luxury? Gasoline is taxed more than mink.

Indispensable gasoline is taxed an average 33%, Milady's mink—10%. When consumers complain, however, about "the high price of gas," they don't seem to know they now pay less (before taxes) for 100 octane gasoline than they did for 50 octane thirty-five years ago. They don't know that two gallons now do the work of three, saving them millions of dollars each year. They don't know, but you do. Next time you get a chance, tell them about it.

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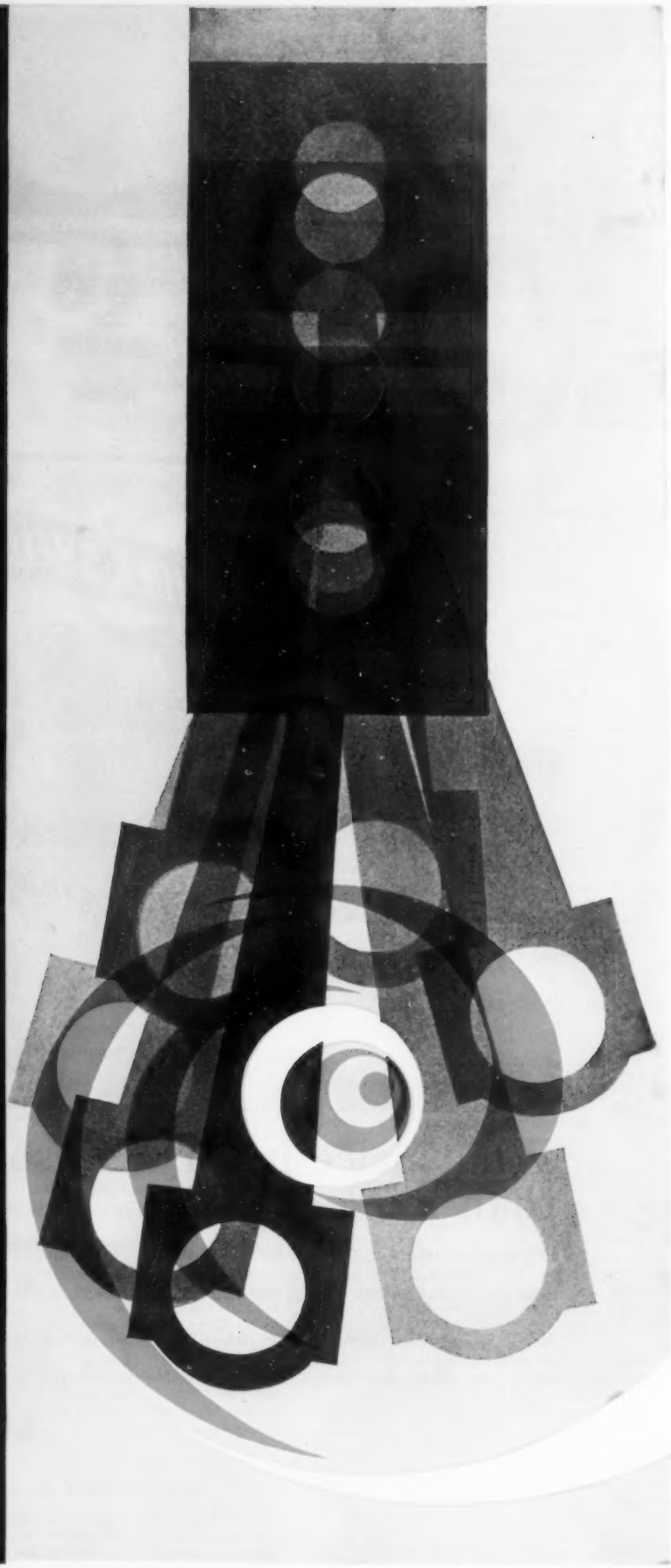

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Esso Petrochemical Expansion

Foster Wheeler Ltd. has been awarded the contract for detailed engineering and plant erection of the £5-½ million extension of Esso Petroleum Co.'s petrochemical feedstock plant at Fawley. The new units, designed by Esso, will include a steam cracker and ethylene and butadiene extraction plants. Completion is scheduled by end-1961.

Lobitos Oilfields' Refinery Project

Lobitos Oilfields Ltd. has completed plans to install a 5,000 b/d atmospheric/vacuum distillation unit at Ellesmere Port, together with ancillary plant, tankage and services. It will replace existing distillation, give increased processing flexibility and allow for future development of the company's specialty markets. Estimated cost is £1.5 million, and completion is anticipated towards end-1961.

Charrington's Expansion Plans

Charrington, Gardner, Locket & Co., sole Mobil fuel oil distributors for a large part of the UK, contemplates capital expenditure of some £1 million for further expansion over the next two years although £1.5 million has been spent in the last three, largely in connection with fuel oil storage and distribution facilities. In the year to March 31, 1960, alone £600,000 was spent on extensions to fuel oil terminals, additional road tankers, and on a self-propelled Thames barge for transportation oil from the Mobil refinery at Coryton to the new depot at Poplar.

The company now has five bulk oil plants—Poplar, Isleworth (Middlesex), Bedworth (near Coventry), Cambridge and Norwich, and also draws supplies from Mobil installations. During 1959-60 Poplar plant capacity was doubled to 40,000 tons; Isleworth was completed primarily to deal with the substantial expansion of domestic oil firing in the west London area; and the Bedworth depot was further extended. Storage at Cambridge is now being expanded and the company is considering entering the west Yorkshire area by the construction of bulk storage to be supplied from Mobil's new £1 million 86,000 tons installation at Ellesmere Port.

The paramount factor in building the 500-ton estuarial tanker, the MV "Charmo", designed and built by Charrington at its Dartford works, was the ability to complete the river trip and cargo discharge in all normal weather in the course of one tide.

Committee Investigates Pipelines

Esso Petroleum's bill to secure the necessary powers to lay pipelines from Fawley refinery to London and to ICI's new chemical works in the west of England passed its second reading in the House of Commons but met with opposition from labor members on the grounds that such lines should be owned and operated by the state.

The Minister of Power said the government regarded these lines as highly necessary in the national interest. Both would be of considerable assistance to the refining industry, and both would enhance the value of the government's pipeline network, to which they would be linked. The line to London and the airport would greatly help to keep down costs and ease London's very pressing traffic problems. Imperial Chemical Industries' chemical plant in Gloucester looked like it will be one of the most important industrial developments in the immediate future and the government was satisfied that the economies accruing through the use of the pipeline would make an appreciable difference to ICI's export potentiality.

Nevertheless the government accepted the proposition put forward that constitutional issues were raised and, if a system of pipelines was to follow the passage of this bill, the private bill procedure was not the appropriate one for dealing with it. Accordingly the government accepted that an examination should take place into the general problem of pipeline development and had already begun to examine the procedure to be followed. A committee would be appointed which would have every regard for the necessity for speed. Future development should be on a rational plan based on clearly established national need.

Good Year's Work by CBMPE

The report of the chairman—G. H. Thorne (Dawnays Ltd.)—on the work of the Council of British Manufacturers of Petroleum Equipment for 1959-60 shows another year of activity and good progress, with membership rising to 531 on May 31 last from 467.

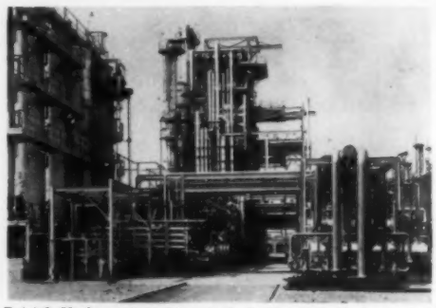
Among the noteworthy achievements was the visit to Mexico by G. V. Sims, CBMPE director, on behalf of its subsidiary, British Oil Equipment Credits Ltd., and the successful negotiations of a supplement to the financing arrangement with Pemex which raised total expenditure in the UK from £3-½ to £7 million. The report mentions the interesting fact that, in this agreement, it is required that the "agreed list" of suppliers with whom orders may be placed shall be compiled from the CBMPE "Classified List of Equipment and Services." This was considerably expanded in the 1959-60 edition and revised to facilitate more rapid location of items and supplies.

Another feature of the year was the publication of the findings of a special committee which studied the corrosion of heat-resisting alloys in the presence of fuel oil ash and by vanadium pentoxide/sodium sulfate mixtures.

The report of the mission to Argentina and Chile under E. F. E. Howard (Hayward Tyler & Co.) has still to be published, but Mr. Thorne admits that while he is confident it will prove fruitful in the longterm development of UK trade relations, "it is the fact that, at the moment, the credit terms sought in both Argentina and Chile cannot be met by this country under the existing credit insurance conditions."

J. M. Storey, CBE, new chairman of the Council of British Manufacturers of Petroleum Equipment, takes office and thanks Thos. L. Bonstow, who has now retired, for his long services as co-founder, technical advisor and technical consultant.

J. M. Storey, CBE (Dewrance & Co.) has succeeded G. H. Thorne (Dawnays Ltd.) as CBMPE chairman, and the latter becomes chairman of British Oil Equipment Credits in place of E. F. E. Howard (Hayward Tyler & Co.). New members of the CBMPE executive committee are J. Neill Thompson (oil companies liaison officer for the Tube Investment Group) and G. C. Fairbanks (assistant managing director, Elliott Brothers (London) Ltd.). Members also learned with regret at the recent annual meeting that Thos. L. Bonstow, technical consultant and for many years technical adviser, had decided to retire after 18 years service to a body for whose creation he was largely responsible and who guided it along lines on which it has developed so soundly.



British Hydrocarbon Chemicals Ltd.'s new ethylene plant at Grangemouth, Stirlingshire.

BHC's Third Ethylene Plant

British Hydrocarbon Chemicals Ltd's third ethylene plant at Grangemouth (Scotland) was completed ahead of schedule and on stream by the end of June. Believed the largest of its kind outside the USA, it will be more than double the existing capacity of the two previous plants.

Conference on Waste Heat Recovery

The Institute of Fuel is arranging a special conference on waste heat recovery from industrial furnaces, to be held at Bournemouth May 15-19, 1961. This is designed to cover both the technology and the economic value of the various methods available. About 20 papers are to be presented and brief synopses of most of these are published. The paper on waste heat recovery in the chemical industry will be by G. Nonhebel, head of ICI's fuel economy section. An exhibition of plant and equipment is also being arranged. Details are available from the institute at 18 Devonshire Street, Portland Place, London, W. I.

New DCL Acetic Acid Process

The Lummus Co. has been selected as the main construction contractor for the £2 million acetic acid plant to be built for The Distillers Co. at Hull (Yorks) using its new DCL process.

First Airport Pipeline Delivery

Shell-Mex and B.P.'s two 9-mile 6-in. pipelines from its Walton-on-Thames storage installation to its depot near London Airport are now in operation, with spur lines carrying aviation fuels to various areas of the airport. The depot has storage for some 2 million gallons and the new supply lines have 720,000 gal/day capacity.

New Films on Lubrication

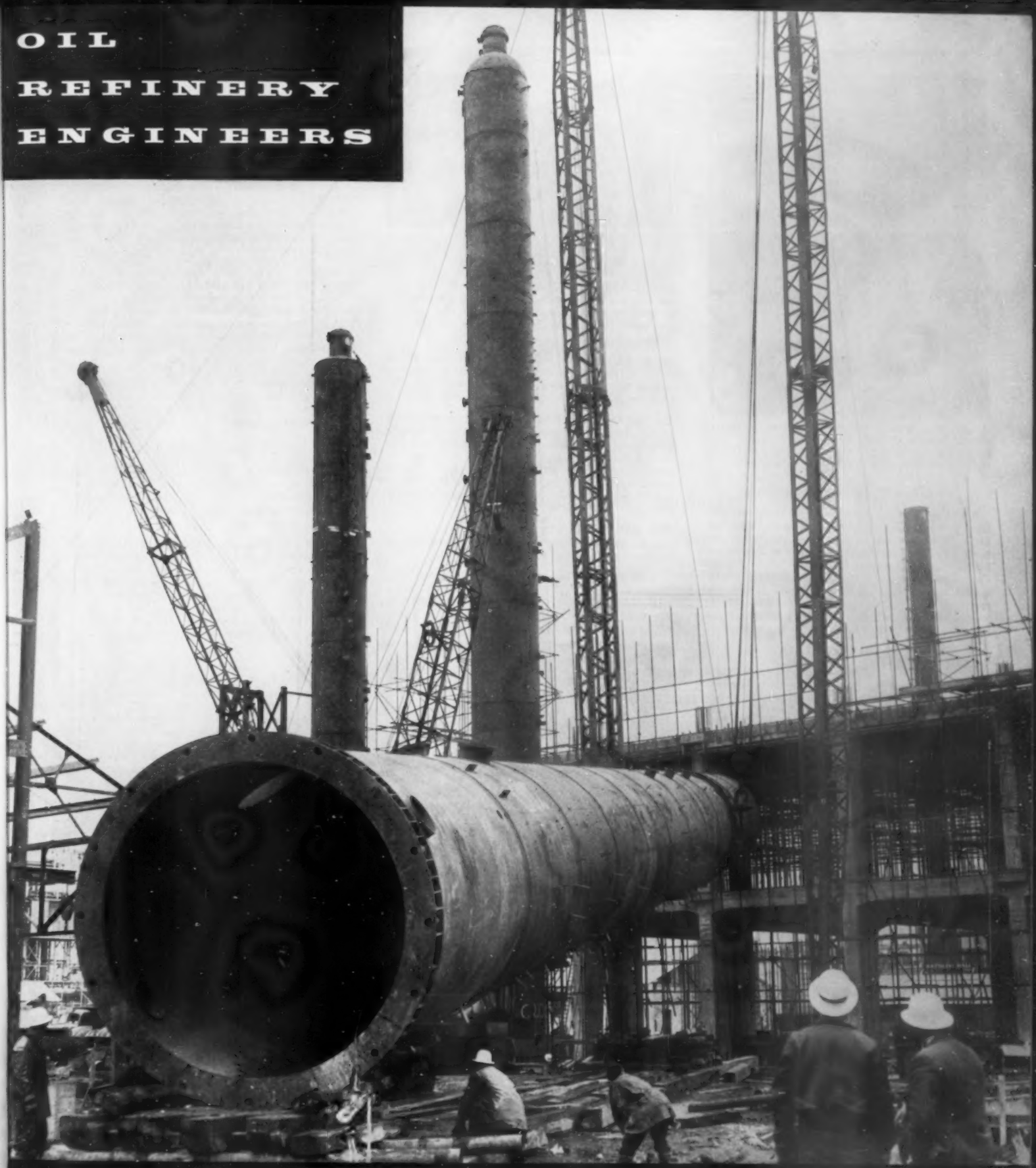
Mobil Oil Co. Ltd. has added two more to the library of films on lubrication available on loan. "Gears and their Lubrication" (26 min) shows how gears are designed and operated, explains the causes of failure, and describes the properties required in a gear lubricant. The second, "Textile Machinery Lubrication," discusses the lubrication of machinery in spinning rooms and weaving sheds as typifying the textile industry's lubrication problems as a whole.

C. C. Wakefield Change of Name

C. C. Wakefield and Co. Ltd., in its 61st year of lubricating oil trading, has changed its name to Castrol Ltd. and, with a trading profit of £4.7 million, achieved record results for the second successive year. Both motor and industrial oil sales were new high records and overseas trading was higher than ever before. The companys' new synthetic lubricant for gas turbines has been approved by the Air Registration Board and Rolls-Royce Ltd. for use in Dart and Avon engines, and the company has been supplying BEA with this new oil for all their Viscount and Comet aircraft since January 1, 1960. New research laboratories are to be built which will enable the Hayes works to be expanded, and other group expansion projects are announced.

(*Continued on page* 10)

OIL REFINERY ENGINEERS



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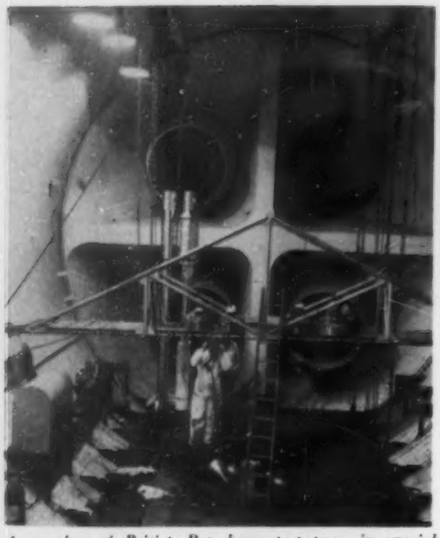


A member of British Petroleum test team in special altitude chamber designed for work on fuels and lubricants company will supply to group planning expedition to Himalaya Mountains.

Fuel for Himalayan Expedition

British Petroleum is supplying all the fuels and lubricants for the expedition leaving London in September for a 20,000-ft. pass in the Himalayas, where the party will live three months in a hut at an altitude higher than man has ever lived before. The company also offered to assist in the development of special heating and cooking appliances for this tremendous endurance test, and to this end has carried out exhaustive tests of fuel and burning equipment at its research center and in a special altitude chamber.

Ardrossan Refinery Extension

The recent opening of the new administration building at Shell's Ardrossan (Ayreshire) refinery was said by E. LeQ. Herbert, managing director of Shell Refining Co., to mark the completion of the major portion of a scheme of modernization and extension. The proximity of the two refineries in northwest England and the BP refinery at Grangemouth removed any economic justification, he said, for the development of Ardrossan as a full-scale crude oil refinery in the postwar development program, but as a specialist refinery it played an essential part in the petroleum supply pattern in Scotland. It was a major producer of bitumen for Scottish roadmaking and also a large storage point from which oil products moved to many parts of the country.

Milford Haven Receives its First Crude

Esso Petroleum Co.'s new 4-½ million ton/yr refinery at Milford Haven, now nearing completion, took in its first cargo of crude early July. This was 32,000 tons from Kuwait, delivered in the 36,040 dwt "Esso Portsmouth," one of several recent British-built additions to Esso's fleet. The new 3,500-ft. long jetty will be able to accommodate two 100,000-tonners simultaneously at any state of the tide.

For reasons not yet established—full technical inquiry is now being held by the company—a fire occurred during unloading, causing serious damage to deck and superstructure. Fortunately, there was only one fatality and three were injured. A remarkable feature is that, though the vessel still contained 27,000 tons of crude, the fire was put out in two hours through the efforts of the crew who stayed on board, and the fire tugs.

Appointments

E. A. HIGGINS, J. F. SINCLAIR and **W. F. G. L. STARRENBURG** have been appointed directors of Shell International Petroleum Co. Mr. Higgins was previously supply and planning coordinator, and Mr. Sinclair and Mr. Starrenburg were regional coordinators—oil for East and Australasia and for Caribbean, Central and South America, respectively.

Dr. M. J. GATTIKER, who was appointed manufacturing coordinator-oil in Bataafse International Petroleum Mij in 1959, has been made a director of the company.

G. N. P. Edwards

E. H. P. Bancroft

G. N. P. EDWARDS has been appointed manager of Mobil Oil Co.'s retail department at head office, succeeding **E. H. P. BANCROFT,** who has become manager of the employee relations department. Mr. Edwards joined the company in 1937 and for the past five years has been a district sales manager in the Midlands.

M. A. BANKS, who was recently appointed to the board of British Petroleum Co. to fill the vacancy caused by the retirement of the chairman, Sir Neville A. Gass, KBE, has been made a managing director.

Dr. ROBERT A. E. GALLEY, who has been director of the Tropical Products Institute in the UK since 1953 and a world authority on pesticide problems, has been appointed manager and director of the agricultural research center of "Shell" Research Ltd. at Woodstock, Kent. He succeeds **Dr. J. E. HARDY,** who is taking up a post with Shell International Chemical Co.

F. K. FARQUHARSON, branch manager at Darlington, has been appointed manager of the motor department of Shell-Mex and B P Ltd.

PETER CRIPPS has been appointed regional sales manager, London and Home Counties, for the industrial division of Wakefield-Dick Industrial Oils Ltd. Mr. Cripps joined the group in 1947 and has been a representative in the London area since 1954.

Peter Cripps

H. L. C. Holliday

H. L. C. HOLLIDAY, previously manager of Mobil Oil's employee relations department, sails in September with his family to join Mobil International Oil Co.'s corresponding department in New York, where he will be regional employee relations adviser for foreign areas.

British Equipment Notes

Decca Navigation Co. Ltd. has received a contract to supply the whole of BP Tanker Co.'s fleet with its equipment, involving over 150 sets eventually. The general adoption of this system is in anticipation of the early establishment of Decca coverage in the Persian Gulf, where stations are now being built.

British Ermeto Corp. Ltd. announces a new range of completely balanced stop valves which incorporate the Ermeto high-pressure joint. Available in various metals, these are fitted with replaceable nylon seats, non-rotating spindles, non-rising handwheels, and have operating threads external to the spindle seats.

Vosper Ltd. has received an order to build a yacht for J. H. LOUDON with an overall length of 105 ft, beam 20 ft 10 in, and fitted with Vosper roll-damping equipment, Sperry "Auto Pilot" and gyro compass, and Decca radar. Two Rolls-Royce diesels driving through reduction gear will give a maximum speed of 12 knots and the electrical system will be powered by two Mercedes Benz diesels.

During one recent month *Stewarts and Lloyds Ltd.* dispatched 17,500 tons of linepipe as part deliveries for three major projects—in Alaska, Brazil and India.

The Alaska Pipeline Co.'s order for 10,000 tons of 12¾-in gas pipe was completed in a race against time to ensure arrival during the workable season. For Brazil, where already £430,000 of pipe has been supplied to the Duque de Caxias refinery, 45,000 tons of linepipe is now being delivered to link the plant with its marine terminal—a total order worth £650,000. The month's deliveries also included pipe for extending the Nahorkatiya-Gauhati line to a second refinery to be built for the Indian government.

Head Wrightson Processes Ltd. has received a £55,000 order from Iraq Petroleum Co. for 10 large "Fin-Fan" air-cooled heat exchangers for cooling lubricating oil from gas turbines at two Syrian pumping stations. Oil outlet temperature will be kept constant automatically.

Richardsons Westgarth & Co., Wallsend, has received order from the Qatar government, worth £500,000 for vacuum flash evaporators. This is for two multistage units, each giving 750,000 gal/day of high purity water. The previous order was for two 150,000 gal/day units. The company is also now installing units on Kharg Island and has one under construction for Abu Dhabi.

General Electric Co. has received a £700,000 order from the Qatar government for two 11-kv, 15-MW single pass-out turbo-generators for installation at the power station being built on Ras Abu Aboud.

US Equipment Links

The Hydronyl Syndicate Ltd. has acquired from Saro Products Ltd. the sole right of supplying in the UK and Benelux countries the plastic tower packing "Dowpac" developed by Dow Chemical Co., of Midland, Michigan.

Under an agreement between the Perkins Group, of Peterborough, and Chrysler Corporation's marine and industrial division, the latter will market Perkins diesel engines through the US and Canada and arrange for their nationwide servicing. It is believed this linking of the world's largest manufacturer and one of the biggest car and truck makers in North America is bound to give tremendous impetus to diesel sales in the USA.

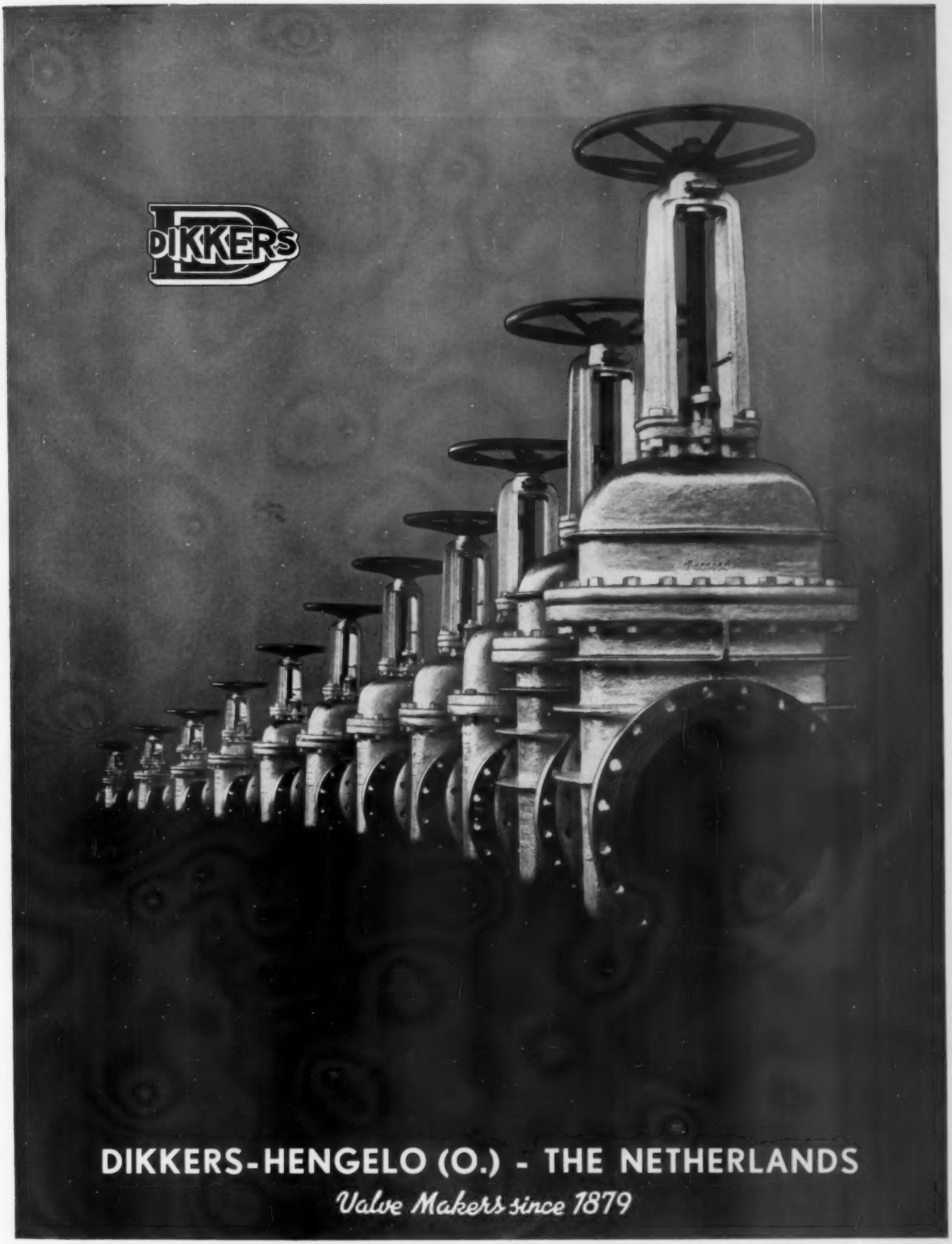
Hallikainen Instruments Ltd. has been formed as a subsidiary by Elliott-Automation Ltd. to give effect to an agreement with Hallikainen Instruments of Berkeley, Calif. Under this, Elliott has secured the right to exploit throughout the world, excluding North and South America and Japan, the range of automatic "in line" process control instruments developed by Shell and made under license by Hallikainen. Elliott-Automation has also recently received a contract worth over £300,000 for the complete instrumentation and control equipment of a refinery which is being built in Assam for the Indian government by a Romanian group.

New Publications

"I.C.I. Titanium 5:m Weight Tables"—This booklet completes Imperial Chemical Industries' new series of publications on various aspects of the properties of its wrought titanium. The contents of this last section are weights (a) per superficial foot of sheet and plate, (b) per linear foot of round and square bar, and (c) per linear foot of rod, bar and billet (standard sizes). Other tables cover footage per pound of wire and weights per linear foot of tube. Copies of the 5 booklets available from Metal Division, ICI Ltd., P.O. Box 216, Birmingham 6.

"Hydraulic Oils"—This publication marks the expansion of the Wakefield Castrol group's technical literature into a new field. Its 74 pages give a clear summary of fundamental hydraulic principles and goes on to describe (with numerous diagrams and charts in color) the main hydraulic systems, pumps and components, and the properties of mineral oil hydraulic fluids. Copies from Wakefield-Dick Industrial Oils Ltd., Castrol House, Marylebone Road, London, N.W.I.

"British Petroleum Equipment News: Arabic Edition"—Published by the Council of British Manufacturers of Petroleum Equipment as one of its occasional special-language editions, this is believed to be the largest issue of an Arabic technical journal to be produced and issued in the UK. Praise must be given to the excellent presentation and printing in the hands of C. H. W. Roles & Associates as editors. This feature alone is worthwhile publicity for British craftsmanship as well as for the CBMPE, which has a limited supply of this publication, price 10s.6d., available at 2 Prince's Row, Buckingham Palace Road, London, S.W.I.



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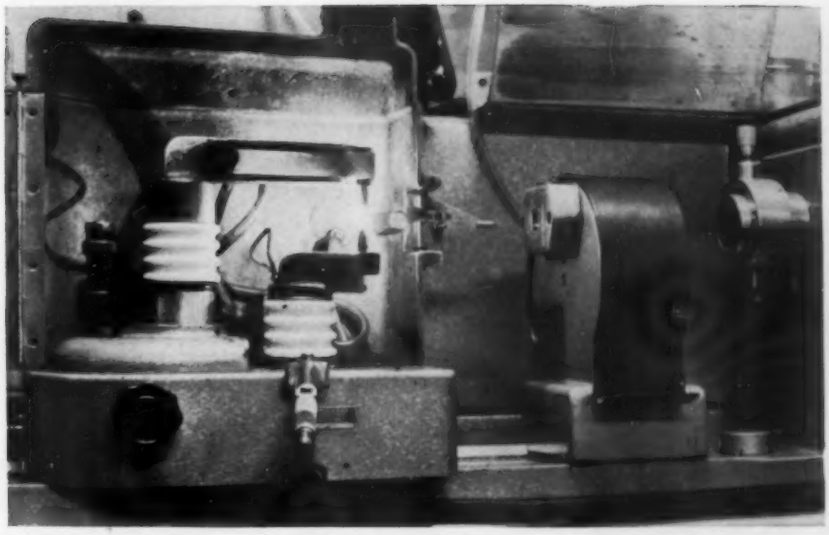
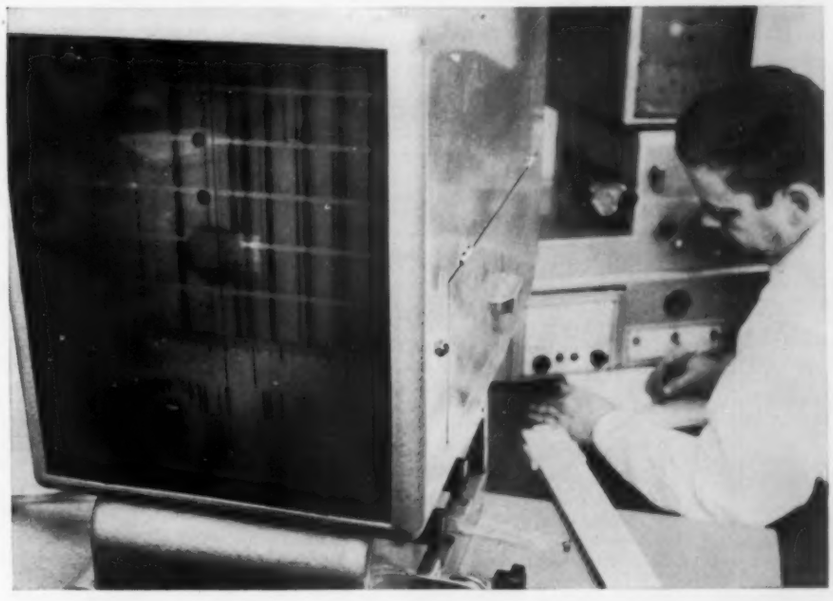


Emission Spectrograph (above) causes undesirable elements in a petroleum sample to emit their characteristic light spectrum which is photographed on a strip of film. In the Densitometer (below) the spectrum on the film is evaluated to identify the presence of metal contaminants down to less than one part per million.



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CANADIAN NOTES

Pipeline Debate Continues

The subject of an Alberta to Montreal big inch crude oil pipeline proposed by a group of independent oil companies including Home Oil Co. Ltd., and Western Decalta Ltd., both of Calgary is still under discussion.

Recently before the Edmonton Chamber of Commerce, Vernon Taylor, vice president of Imperial Oil, said that the basic principle to be remembered about marketing Western Canada's oil is that quotas and restrictions can prevent imports, but cannot produce exports. The growth rate of Canada's oil industry cannot be maintained without steady growth in exports "for export growth, a competitive rather than a highly protected industry, is essential."

Mr. Taylor said it was not usual to ask for government assistance for an industry which is expanding at twice the rate of the Canadian economy. "The long and the short of it is that we are by no means a depressed industry," he said.

The market for Canadian crude should expand 9% this year, permitting a production close to 600,000 b/d by year-end. Construction should also be well along to enable the export, by 1962, of the amount of natural gas equivalent in energy to 150,000 b/d of oil. Looking further ahead at the growth of demand in Canada and in logical and economic export markets in the U. S., production should reach nearly 1,250,000 b/d in the next 10 years—about 2½ times the 1959 production.

He noted the substantial changes which had occurred in the two years since he last spoke about oil in Edmonton. Western Canada crude oil production is up 20%, natural gas output up 50% and production of natural gas liquids up 135%.

To the question, "Why don't we prevent foreign crude from being used in Montreal refineries, etc.," he offered one very short answer. It was "the same reason that we don't force Quebec or Ontario to use Maritime or Alberta coal—transportation and other penalties would outweigh the advantage."

Mr. Taylor then posed seven questions about the Montreal pipeline issue, and answered them as follows:

1. "Can Western Canadian crude compete in Montreal with offshore crude at present posted prices?" On the basis of posted prices, Redwater crude is at a disadvantage of 23 to 39 cents a barrel when competing with Venezuelan or Middle East crude laid down in Montreal at prevailing tanker rates. This is a realistic appraisal based on a 60 cents a barrel pipeline tariff (the amount now paid for movements as far as Toronto) and on parity of the Canadian and U. S. dollars. To capture the entire Montreal market, Western producers would have to cut at least 39 cents a barrel from field prices which are already below North American levels. Overseas producers would probably lower their prices further at Montreal to hold that market.

2. "What problems do we face in trying to secure permanently the market in Montreal for Canadian crude by a system of quotas or other restrictions?" Closing the price gap between Western Canadian and offshore oil by political means (and against the interests of consumers) only assures continuance of the measure for so long as the political party which imposed it remains in power and continues to favor this action. It would entail asking Montreal refining companies to guarantee between $300 and $400 million of long-term funds on the basis of a short-term political pledge.

3. "Would the restrictions apply to Montreal only?" No, nor could they apply only to crude oil. Steps would have to be taken to prevent foreign products from pushing back Canadian-based ones; to prevent Halifax and Saint John refineries, which would use imported oil, from expanding at the expense of Montreal refineries. Regulation to this end of the business tends to spread back to the producing field and could bring control of the price at which Alberta sells its crude.

4. "In imposing controls and quotas, would not Canada be following a 'national' oil policy just like other countries?" No, the U. S. controls may look similar, but they are aimed at protecting a market which in most cases had already been supplied from domestic sources through existing transportation facilities. The type of restriction proposed for Canada is not defensive but aggressive, designed to take markets away from other suppliers.

5. "Is not the expansion of the crude oil market represented by supplying Montreal essential for the survival of the small independent crude oil producers?" It would help them to some extent in the short term. Actually many small crude oil producers are represented in fields which, under the Alberta system of prorationing, are already producing pretty close to capacity. It is the major producing companies, represented in such pools as Redwater, Leduc, Wizard Lake, Bonnie Glen, Fonn-Big Valley, etc., which would benefit most by a sharp increase in markets.

6. "Just how well or badly is the Western Canadian oil industry faring today?" Oil revenues in 1959 were $425 million, up 6% from 1958; gas revenues of $31 million were up 35%; exploration drilling was up 7% and development drilling down 10%; land holdings, excluding the Arctic, about the same; and total exploration and development costs about the same.

7. "If not a pipeline to Montreal, what policy should we be pursuing?" Saturation of southern Ontario with Canadian crude and products displacing imports is desirable, he said. Further, if Canada is to expand its markets it must be through exports, and this means principally exports to the U. S. Not only do these exports give as favorable a price at the well as is possible to achieve, and considerably more favorable than shipments to Montreal, but we have been given in this market a status equal for practical purposes to domestic American crude.

Texaco Sets Up Sky Service

Texaco Canada Ltd. has set up the first of three Sky Service Centers at Dorval Airport in Montreal.

Believed to be the only one of its type in the world, the service is primarily designed to serve business and private aircraft and their passengers. The service at Dorval is the first to provide standardized design, facilities and service in North America. Two more such units are planned this year at other locations in Canada.

Using a uniform design, each of the 30 by 50-ft sky service buildings will provide a conference room where a flying businessman can hold meetings with his staff, clients and/or customers. Communication equipment will enable the businessman to keep in touch with his office or with the next sky service center on his itinerary. The service also includes direct phone lines to major cities, car rental and taxi service as well as catering services.

Pipeline Rate Cut

Interprovincial Pipe Line Co., Toronto, will cut rates by 1¢ to 7¢ per bbl, effective November 1. New rates will be Edmonton to Regina, 20¢ per bbl; to Superior, Wis., 37¢; to Sarnia, 50¢; and to Toronto, 54¢.

Canadian Oil Pricing

Major oil companies report there will be no price adjustment on crude oil due to reduction of Canadian dollar-exchange premium. They say price was actually out of line when discounts on the USA dollar reached 6%. Present 2% discount is reasonably in line competitively. Interprovincial tariff reduction of 1¢ to 7¢ on November 1 will create a safe competitive margin.

Arctic Island Permits

Canadian, American, and British oil and gas companies were represented in the permits granted June 24 for the Arctic Islands. Total area reported taken up was 39,046,000 acres, all covered by 12-year exploration permits—each permit covering a grid or a half-grid. Smallest permit covers about 23,000 acres, and largest some 74,000 acres. They are in the central parts of the Arctic sedimentary basin. One geological authority puts the maximum thickness of these sediments at 80,000 ft, and another estimates possible recovery of crude at 100 billion barrels.

Gas Processing Deferred

Proposed gas-processing plant for East Calgary field, being proposed by Jefferson Lake Petrochemicals of Canada Ltd., will not likely be built before 1962. Project has to tie in with completion of export pipelines and Alberta Trunk foothills pipeline system, both probably due for fall of 1962.

Canadian Gas Export

Impression prevalent in Canada is that major gas-export pipeline projects will not be approved in USA until after the coming November presidential elections. FPC has taken no steps to expedite decision on Westcoast and Alberta & Southern. Only Trans-Canada line south from Manitoba is going to be delivering gas this year.

Heads Shell Land Division

The appointment of E. Falk as Shell Oil Co. of Canada's Calgary division land manager has been announced by R. N. Gadbois, land manager. Mr. Falk succeeds J. C. Ebbels who will become area land agent in Calgary. D. O. Cole, former area land agent, in Calgary, returns to the United States to take a similar position with Shell Oil Co. in Denver.

A native of Lowe Farm, Manitoba, Mr. Falk joined Shell in 1952 and has served the company in the land department in various capacities in Calgary and Edmonton.

Husky Merger

Canadian Husky Oil Ltd. has acquired 87% of the common stock of Husky Oil Co. of Cody, Wyo., with the latter now a subsidiary of Canadian Husky. Integrated operations—including production, refining, pipeline transportation, and marketing—are expected to commence immediately.

Trans-Canada Buys Turbines

Clark Compressor Co. Ltd., Calgary, has sold three gas turbine centrifugal compressor sets to Trans-Canada Pipe Lines Ltd., as part of the latter's multi-million dollar expansion program to export natural gas to the United States. The turbines are rated at 8,370 hp each and will drive Clark 30" x 30" Single Stage Centrifugal Pipeline Compressors which will pump approximately 700 mmcf/d.

Quebec Gas Troubles

Quebec Natural Gas is in for a complete overhaul. Company expects to report net loss of $5 million for fiscal year ending June 30, 1960, due to slow buildup of new business and failure to get franchises outside of Montreal. All natural gas utility expansion in Quebec province outside Montreal is deferred until 1961 at least.

Peace River Line Delayed

Jurisdictional problems, including delay in getting hearing by National Energy Board, are expected to delay British Columbia oil pipeline of Peace River Pipe Line Co. Ltd. until 1961. Line would provide outlet for up to 25,000 b/d of northeastern B.C. crude oil to Vancouver refineries.

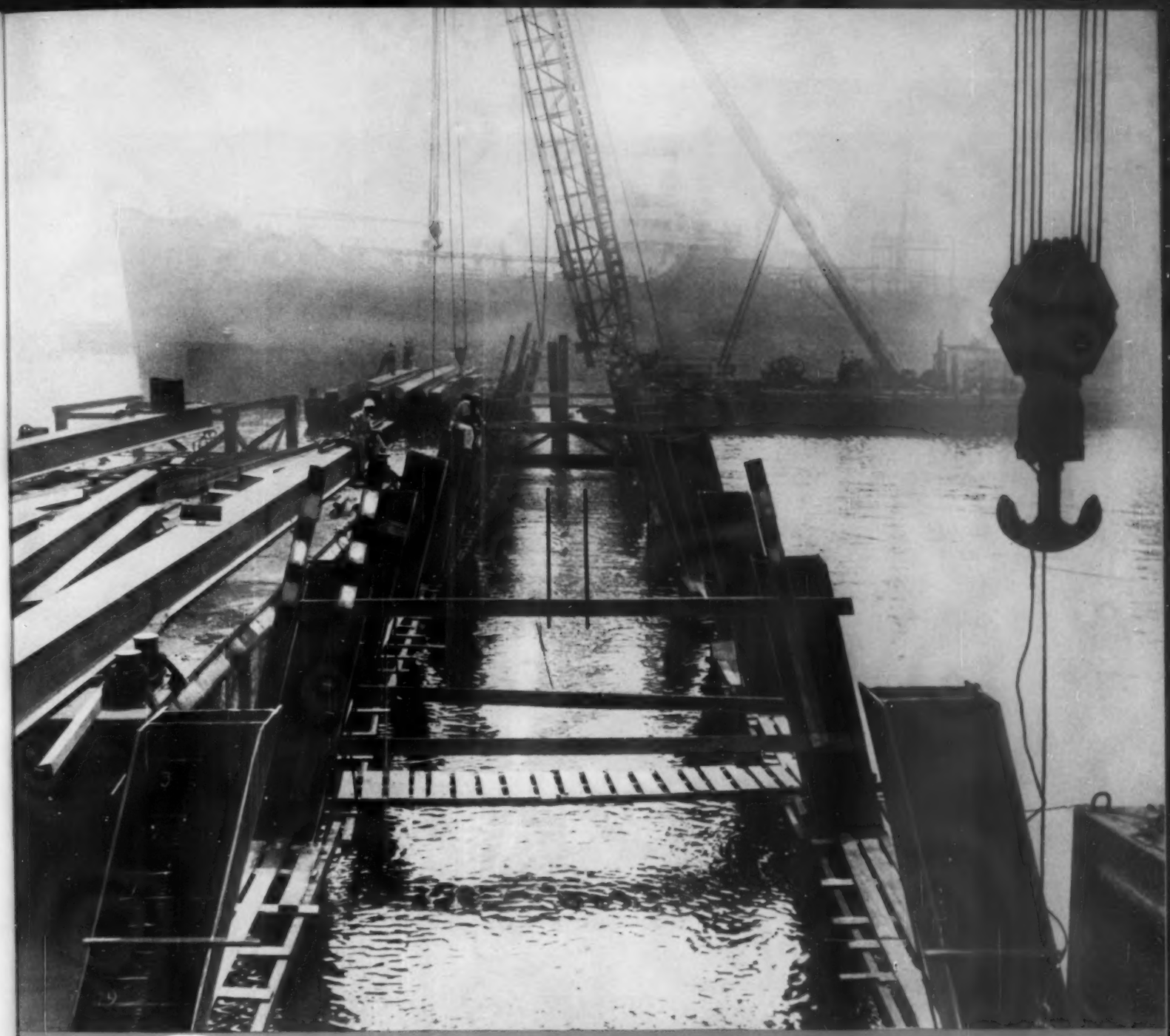
Williams Bros. In Panama

Williams Brothers Co., Tulsa, in a joint venture has signed a contract with the Panama Canal Co., an agency of the U. S. government, for the widening of a portion of the Panama Canal. Work to be done is in the Empire Reach area, and entails the removal of about 7,300,000 cubic yards of earth and rock. Williams also announced that the firm has signed a contract with the Peace River Oil Co. for construction of approximately 37 miles of 8⅝-inch pipe in Canada.

Williams Brothers also are sponsors in a joint venture that has a contract with the Alberta Gas Trunk Line Co., for engineering, design, material procurement and construction supervision of approximately 100 miles of natural gas pipelines in various diameters up to 24-inch, all in the province of Alberta, Canada.

Another newly announced contract is with the Manufacturers Light and Heat Co. for the installation of approximately 70 miles of 20-inch natural gas pipeline in various diameters up to 24-inch, all in the province of Alberta, Canada.

Another newly announced contract is with the Manufacturers Light and Heat Co. for the installation of approximately 70 miles of 20-inch natural gas pipeline extending from Bethel Township, Fulton County, Pa., to Abbottstown Boro, Adams County, Pa. Williams Brothers is opening a field office at Gettysburg, Pa., and construction has begun on this project.



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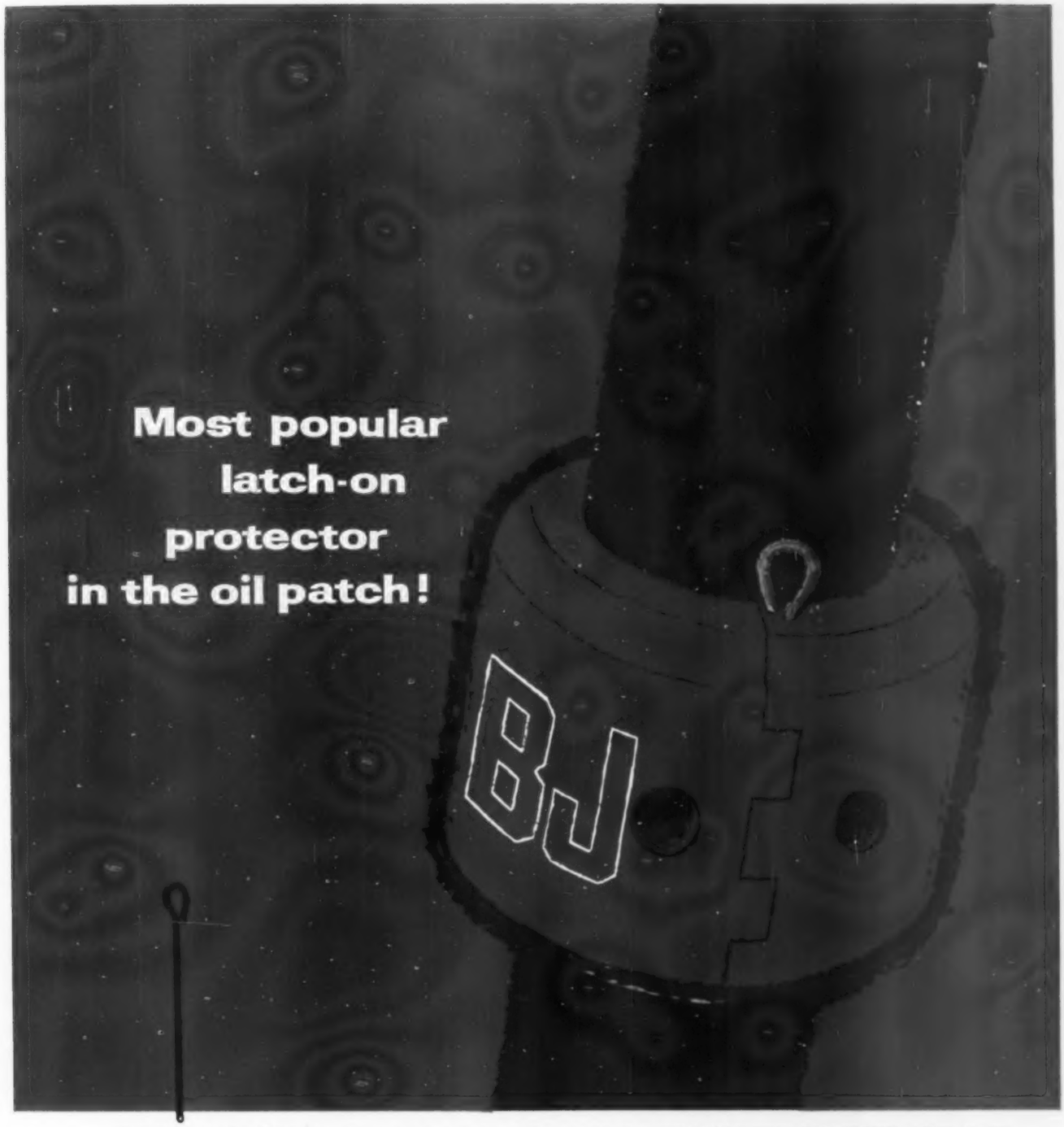

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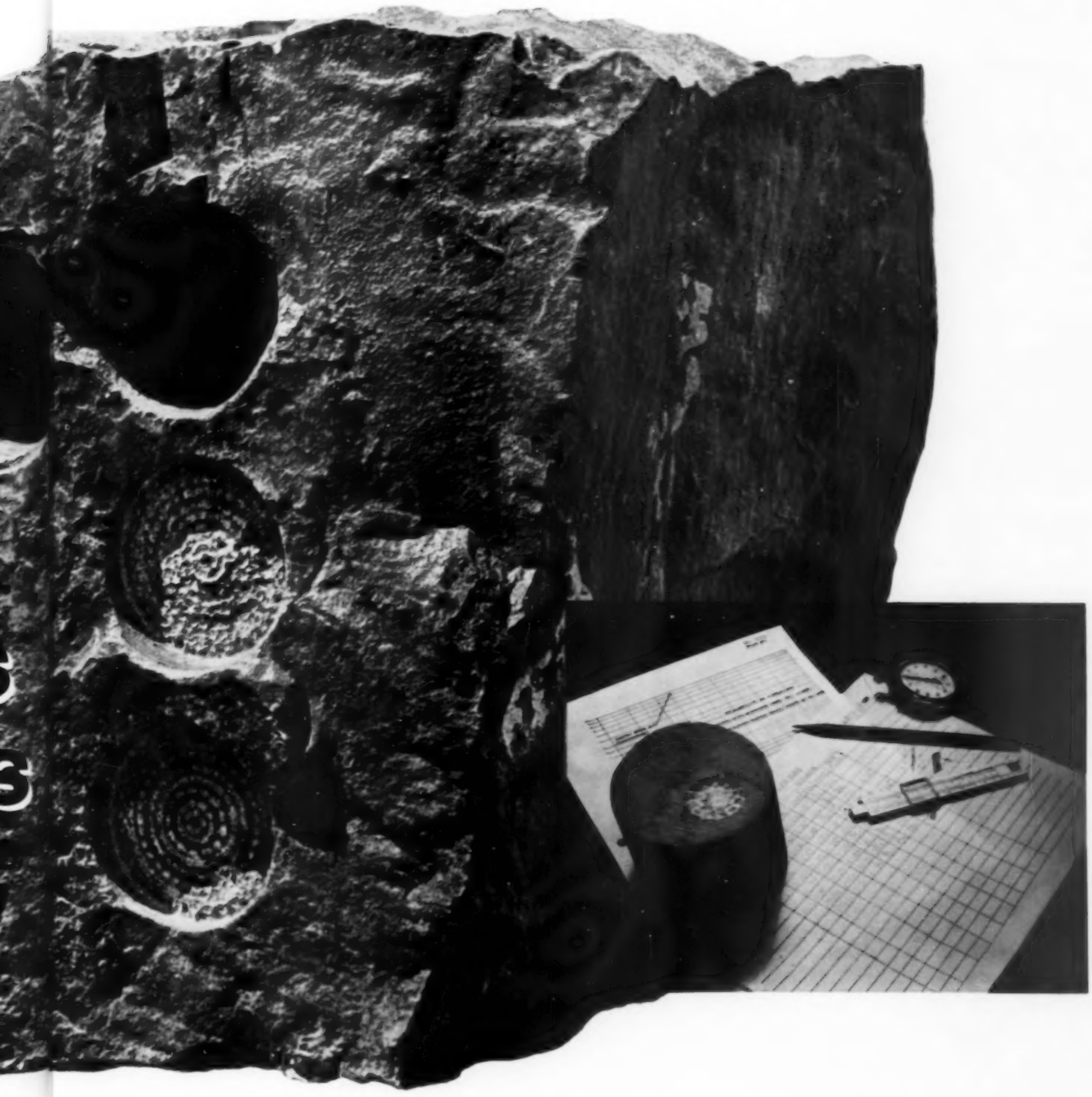

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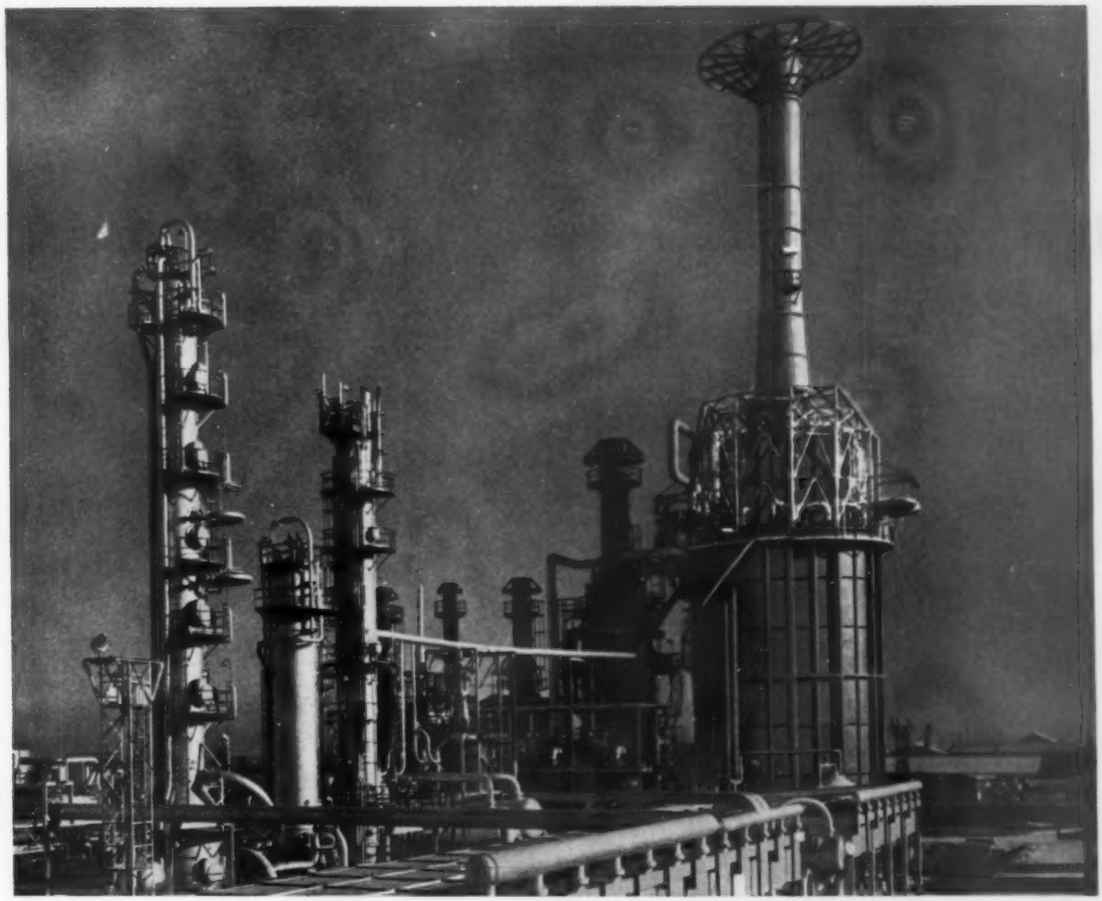

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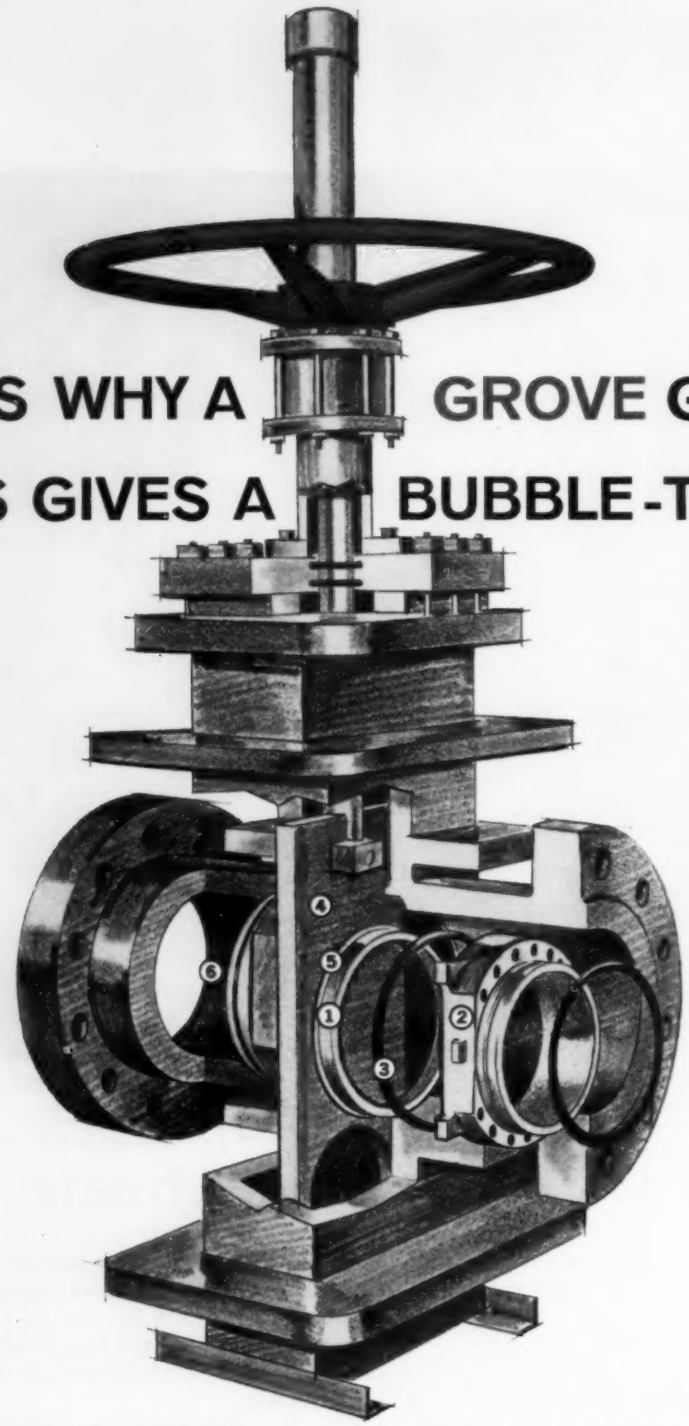

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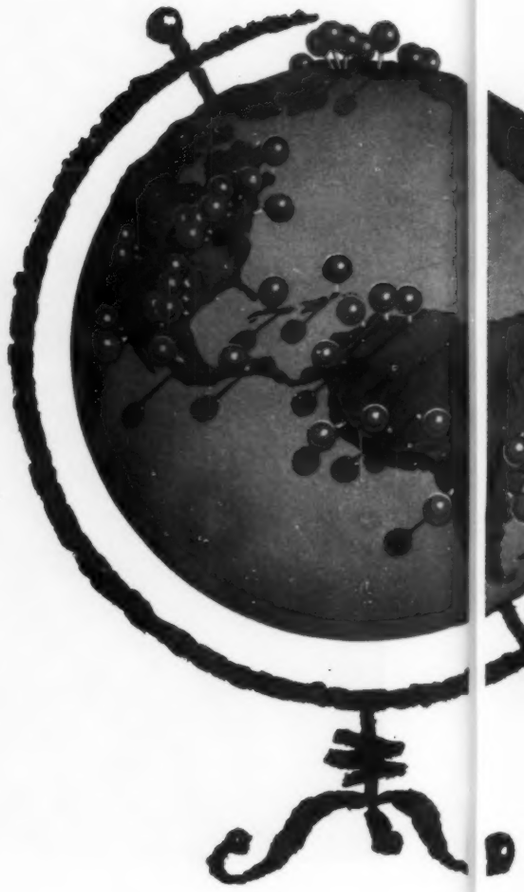

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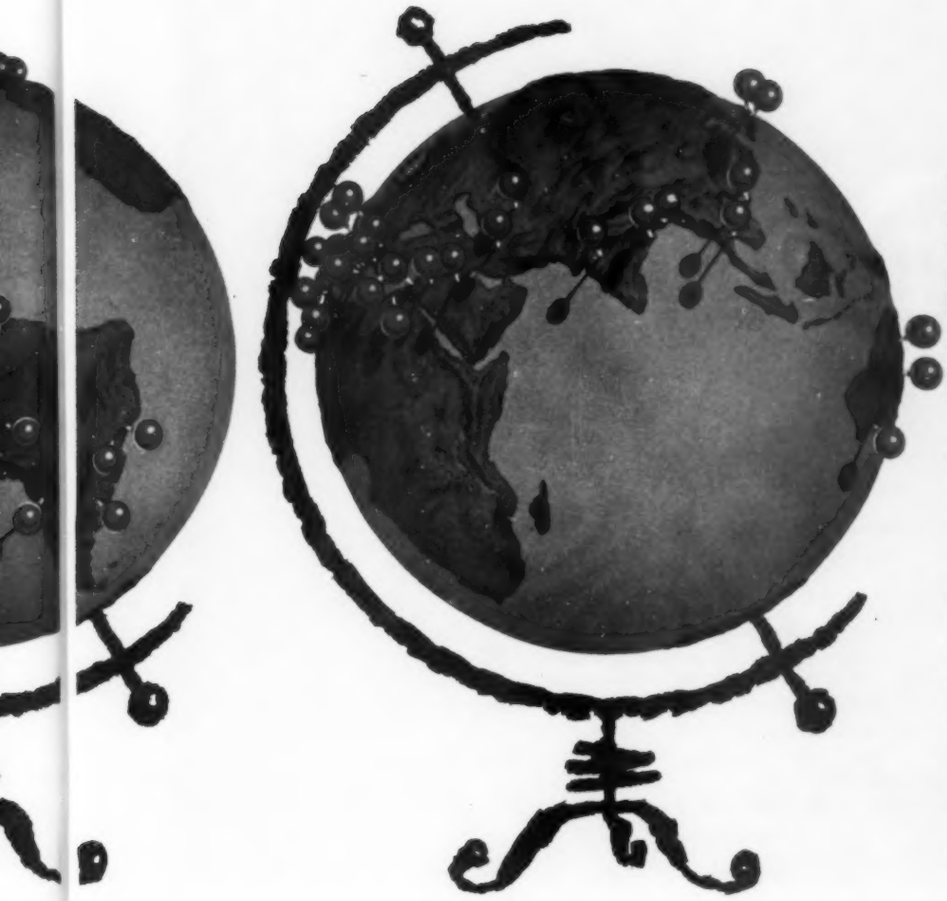
TOMORROW'S PROGRESS PLANNED



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SECURITY ENGINEERING DIVISION
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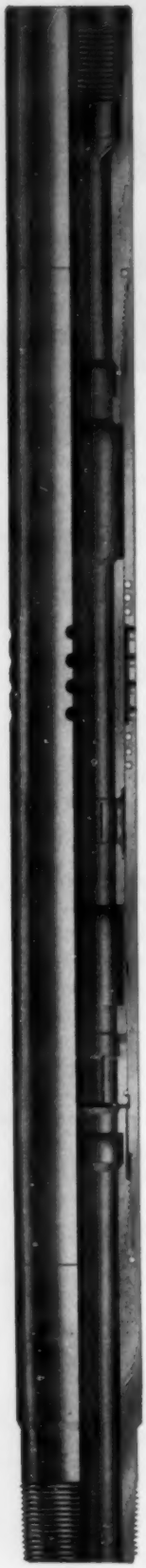

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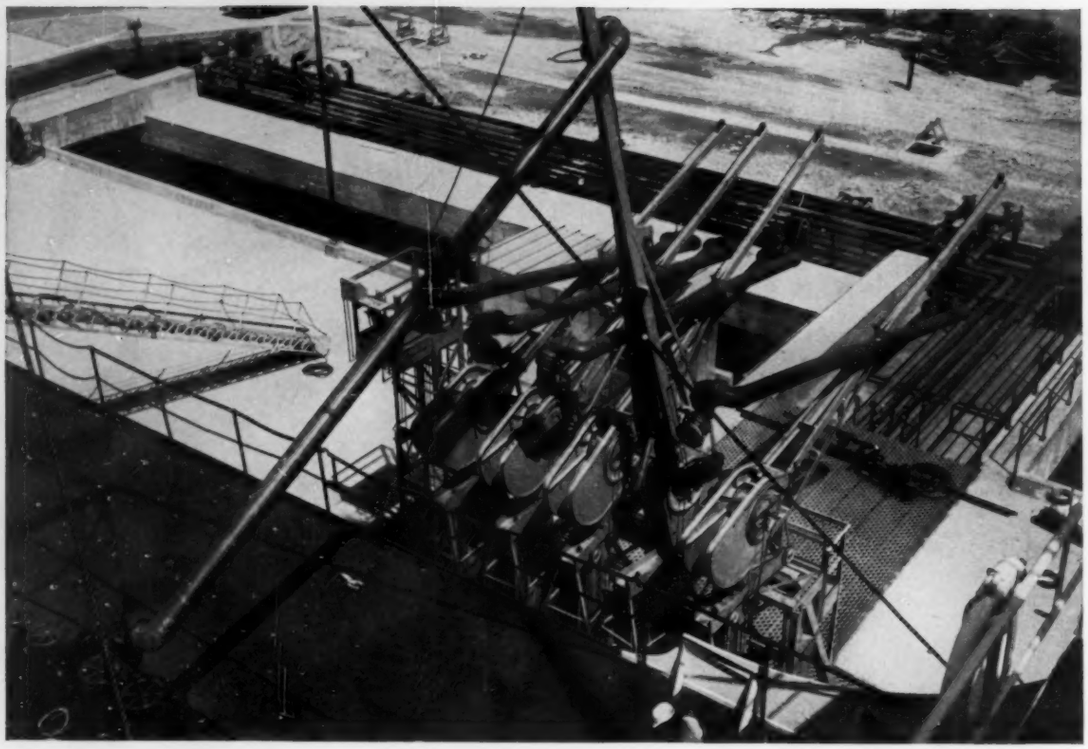

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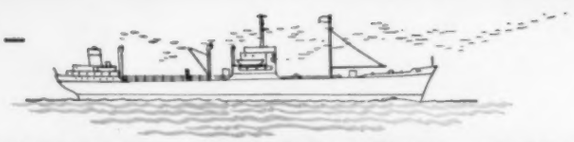

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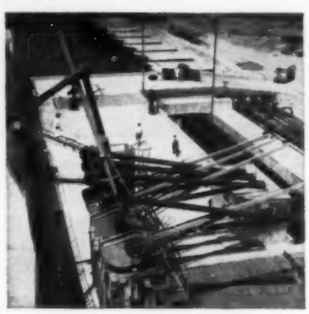

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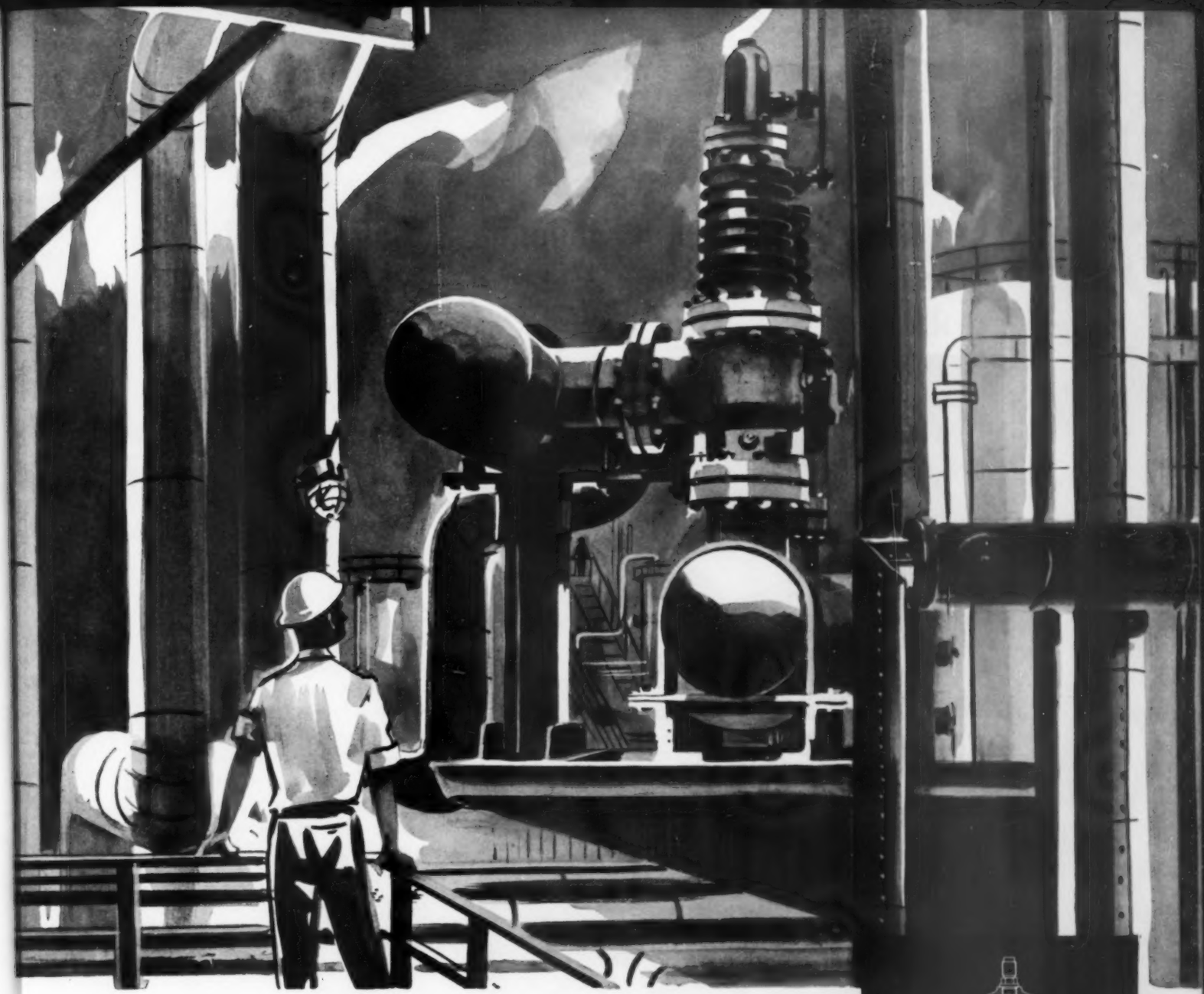

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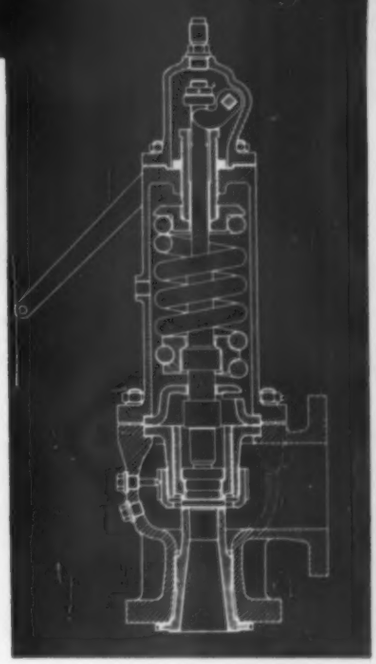

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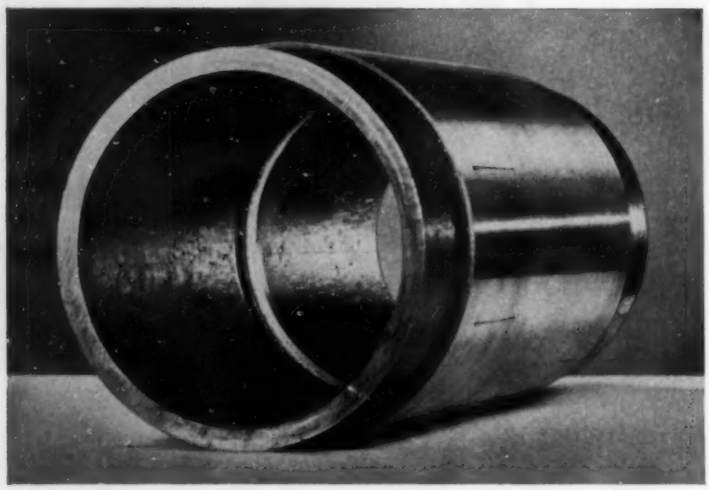
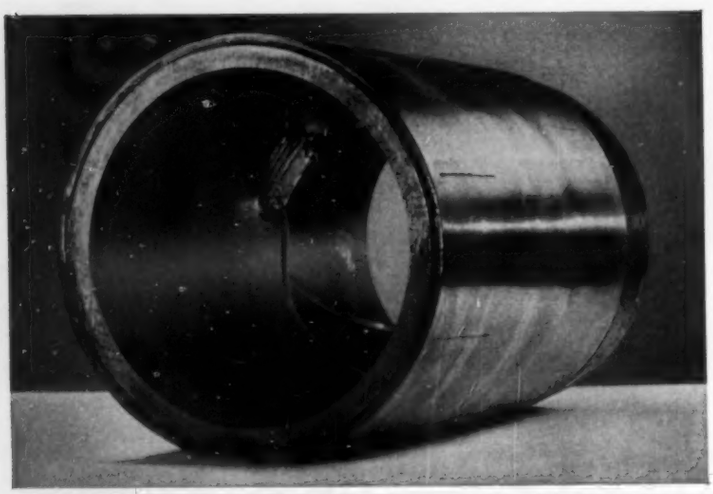


BEFORE A National Super Deep-Well Coupling, containing two sections of 7⅝" O.D. Deep-Well Casing with Buttress-Thread. Each section projects 2" from coupling.



AFTER The power hammer has driven one section of the casing into the coupling to meet with the other section. Both sections are a mass of distorted and twisted steel, yet the casing coupling did not fail.

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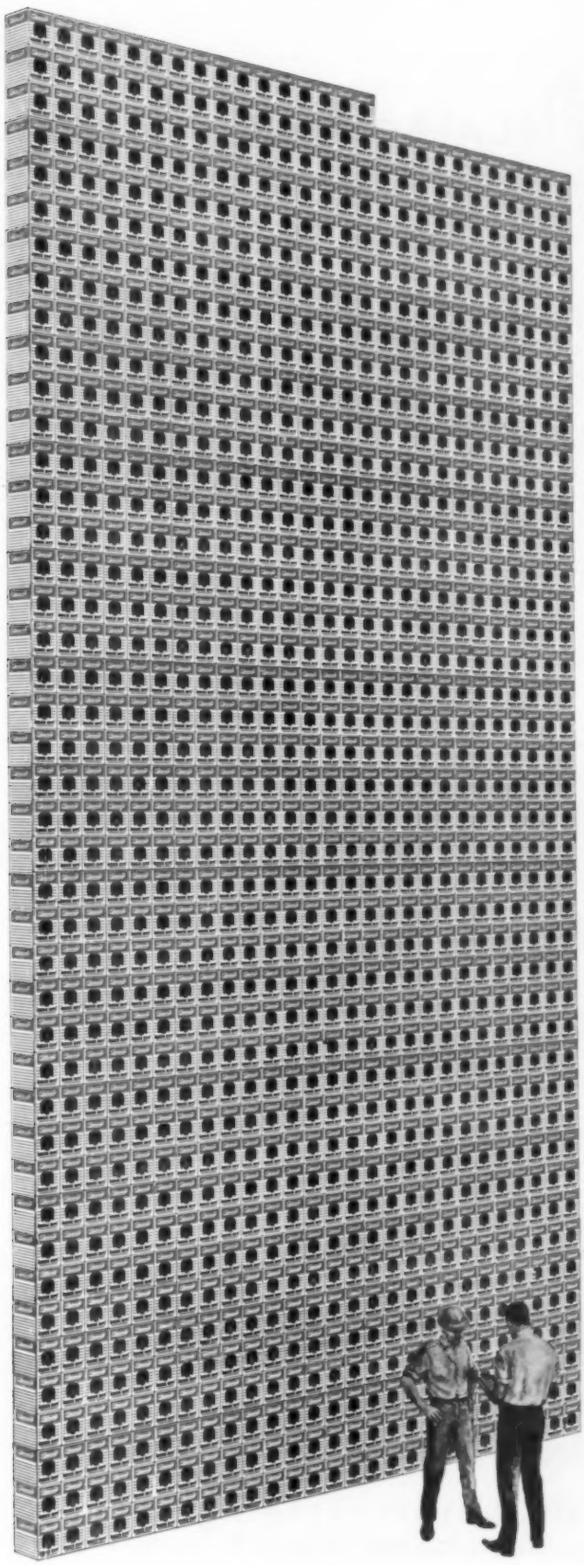

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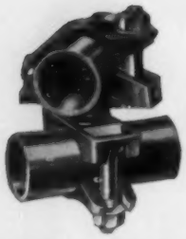

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Map drawn and edited by the Institut Géographique National.

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IN WESTERN GERMANY

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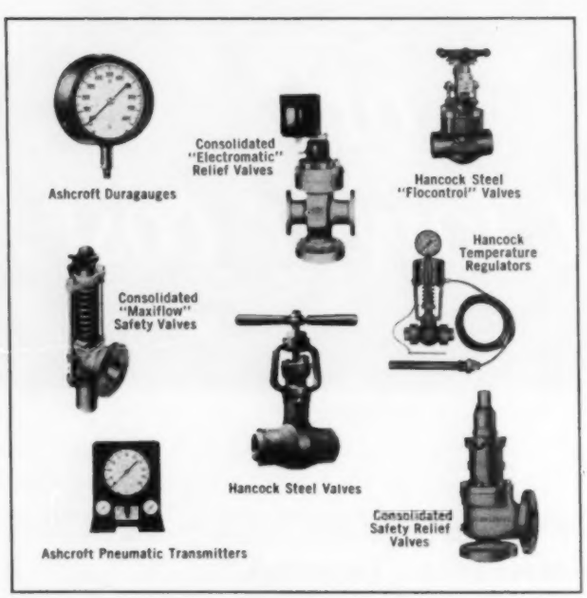

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Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario
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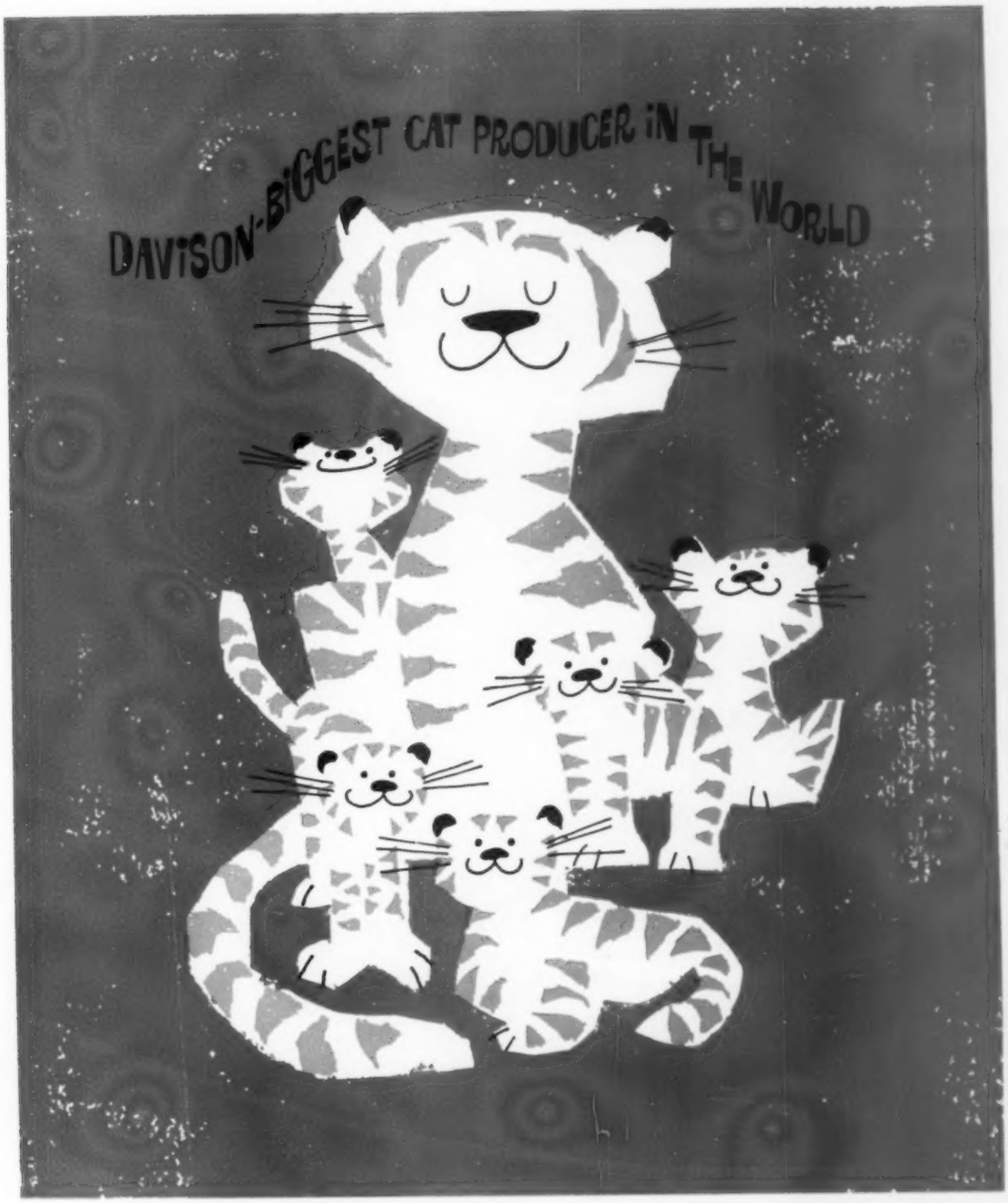

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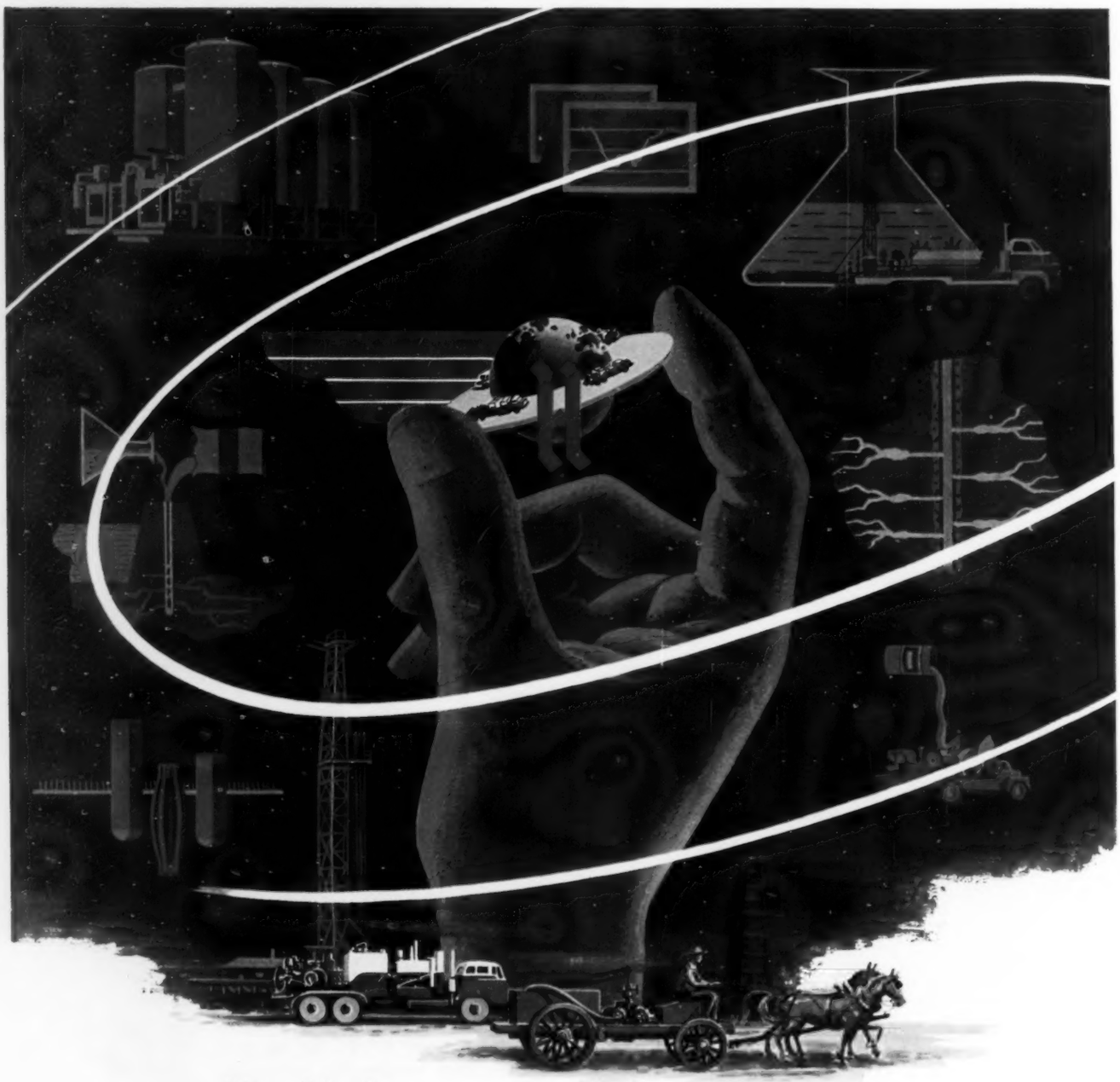
Continue to look to Halliburton Company for *leadership* in cementing, formation fracturing, testing, chemical services, and a wide range of other oil field services.

Halliburton Company's expanding orbits of service will continue to mean the *very best* in quality and performance for its customers . . . worldwide.



Halliburton COMPANY

DUNCAN, OKLAHOMA

A Step Towards Price Stability

For many years "Group 3, Oklahoma" was the key market for refined oil prices in the United States in the same way that "Pittsburgh Plus" was the key to domestic steel prices. In more recent years a number of primary refined oil markets have become recognized and may be considered of equal or greater importance than Group 3.

In international trade the USA Gulf cargo market has been looked on as the key to world prices for petroleum and its products. Delivered prices have been based largely on USA crude and refined oil markets plus cargo freight to destination.

The Gulf now has lost its position as the world's key market. A number of factors have contributed to this but the most important has been the import restrictions established "in the interest of national defense." The barrier against oil imports has, in fact, maintained the domestic market at a higher level than would have prevailed under a *laissez faire* economy operating under the full impact of flush fields in Venezuela, Africa and the Middle East.

During the first half of this century the USA was a net exporter of petroleum but since the close of World War II American exports have dwindled to a trickle of special products and the nation has become a large importer. This, of course, is another important reason why Gulf cargo markets have ceased to be the key to world prices. It may be doubted whether the Gulf will ever again be a dominant factor.

At the moment it seems likely that a number of base markets may develop. In the Western Hemisphere Venezuela is the key market and is likely to remain in that position. In the Eastern Hemisphere it may be that Persian Gulf postings will rule markets east of Suez and North African postings rule the European market.

There is a good deal of discussion among oil industry economists regarding the desirability of establishing postings in the Middle East and in Venezuela which are more realistic—not a level to start cutting from. There are markets, of course, where haggling is the normal means of arriving at a selling price. In many of these the traders would feel robbed of much of the pleasure of doing business if they were deprived of the excitement of bargaining. In a world industry, however, it is difficult to operate unless prices on goods are plainly marked so that any buyer can see what his cost will be. The machinery of operating large corporations is subject to great strain when trading is on a bargaining plane. Rumors are rife in the market place that so and so has sold a cargo at a few cents under the last known deal and these rumors cannot help but contribute to further demoralization. Top management must divert its attention from normal administrative problems to consider and approve individual transactions. Obviously salesmen cannot be given permission to sell at cut prices without responsible management authority.

International competition has been further complicated in recent months by the more aggressive sales tactics of the USSR. For the past 30-odd years Russia has been content to sell any surplus oil it might have to offer at posted world prices. Recently, however, the politicians in the Kremlin have been using cut prices on oil to create trouble for the West in sensitive spots—a 20% cut in India, for example, compared with cuts of 5 to 10% in less sensitive areas.

The market structure is made more complex by the interest of Middle East and Latin American governments in avoiding tax losses. Leaders in the principal exporting nations are groping for methods by means of which markets can be sustained. Saudi Arabia, for example, has proposed an international proration scheme to fit supply to market demand. This proposal presents many difficulties as is indicated by comments of industry leaders beginning on Page 40 of this issue.

Venezuela is making a manful effort to support prices by preventing producers from selling crude below the market. This works to a limited degree in the case of producers who do not have their own markets. In the case of the majors it doesn't work. Creole officials have been quoted as saying that half of their Venezuelan oil is moving at sub-standard prices. What happens is that Creole sells the crude to an affiliate at posted prices but the affiliate has to cut product prices to get orders.

Obviously this is a condition which cannot endure over any great period. Venezuela will lose business and its tax revenues will fall unless its crude prices are competitive.

Part of the responsibility for the present situation must be accepted by the exporting nations whose leaders have been pressing for more production by their concessionaires without reference to market outlet. There are current examples of this in the Middle East particularly. Venezuela's administrators have taken a somewhat harder line, telling producers to cut back their output if it cannot be sold at a fair price.

Recognition of market realities by oil marketers in India and by the recent cuts in Middle East postings are a healthy sign. The unhappy situation now existing in world oil trading will be cured more quickly if a realistic market is established at levels where prices are plainly posted and rigidly observed.

Sir Neville Gass

Hon. M. R. Bridgeman

L. F. McCollum

Oil's outlook in an era of plenty

as seen by leaders in the international petroleum industry — rapid growth in demand plus good management will bring needed correction; international proration believed not feasible.

MIDWAY THROUGH the second post-war decade the international petroleum industry is pausing to take stock of its situation. As it has many times in the past, the industry finds itself in a period of plenty with strong pressures being exerted by oil which is not readily marketable.

In the first decade following World War II the industry did not have a comfortable reserve of currently producible oil. Demand was rising sharply in both hemispheres and producers in the USA who had oiled two global struggles were not finding new flush wildcat results, and, encouraged by the national ambitions of previously non-petroliferous countries, the industry's geologists and geophysicists fanned out over most of the world's great sedimentary basins and in their footsteps followed the driller. Results of the intercontinental search have been phenomenal.

Although "big oil" continued to elude wildcatters in the USA the domestic market has not been starved for supplies. Improvement in secondary recovery techniques have enabled the industry to lift a far greater percentage of their known reserves each year. Investors in recovery projects have resisted proration and clamored for tight restrictions on imports.

Adding to the world competition for available markets outside the USA has been a growing volume of crude and products from the USSR. The Russian oil has been offered at cut prices and under terms which the average oil company cannot hope to meet. Acceptance of commodities in barter or nonconvertible currencies by the Soviet industry clearly has been politically inspired. A report on current market activities of the USSR is given elsewhere in this issue.

Meanwhile the industry is heartened by the continued rapid growth of demand for petroleum, particularly in the eastern hemisphere. The United Kingdom with an increase of 21% in first quarter demand, Western Germany with a rise of 44%, Europe with a rise of 15%; and other similar percentages in important consuming nations have led economists to reiterate their earlier estimates of tremendous market expansion during the 60's. A study by WORLD PETROLEUM beginning on page 45 suggests a global increase in 1960 demand of nearly one million barrels daily, or about 6%.

With ample supplies in sight and growing market outlets assured, oil industry leaders are turning their attention to reducing their costs and generally tightening up on their operations. Much thought is being given to the best way to live and make a fair profit in an era of plenty.

WORLD PETROLEUM has asked the heads of a group of international oil companies to express their views on the outlook for the industry and on recent proposals for international proration of production designed to give oil exporting nations a specified share of the available market.

Quoted below are replies from Sir Neville Gass, K.B.E., M.C., retiring chairman of British Petroleum Co. and from his successor, the Hon. M. R. Bridgeman; from L. F. McCollum, president of Continental Oil Co.; from H. Wilkinson, C.M.G., a managing director of the Royal Dutch/Shell group of companies; E. L. Steiniger, president of Sinclair Oil Corp.; A. L. Nickerson, president of Socony Mobil Oil Co.; T. S. Petersen, president of Standard Oil Co. of California; M. J. Rathbone, president of Standard Oil Co. (N. J.); Augustus C. Long, chairman of Texaco, Inc.; and from the chief executive officer of another major international oil company. The various statements follow:

by Sir Neville Gass
Retiring Chairman, British Petroleum Co.

The figures so far available in respect of the present year indicate that consumption is expanding at a good rate, and for the first three months our sales tonnage was more than 15% above the corresponding period in 1959. I hesitate to make too much of these results for three months only, but we can, I think, regard it as a good

H. Wilkinson

E. L. Steiniger

A. L. Nickerson

start to the year, showing as it does an appreciable increase in the volume of sales from which, although prices have remained depressed, the income from trading also has benefited.

The industry is fortunate in being able to look forward, in normal circumstances, to being called on to provide enormously greater quantities of its products in the next few years.

In the shorter term, conditions will continue to be difficult because we are in a period in which available supplies are so much greater than current demand. The industry has been in a somewhat similar position on previous occasions. It needs to have a margin of potential supplies and, with the growth of consumption, the present acute difficulties of imbalance should be progressively overcome. The responsibility for bringing this about rests on all within the industry, calling as it does for constructive planning and for restraint by all of us.

The difficulties of the present situation, though not likely to disappear in the immediate future, should not be allowed to obscure the encouraging longer term prospects of the oil industry. The growth of population, expansion in world economy, industrialization and improvement in living standards, particularly in underdeveloped countries, will be accompanied by a continuing increase in the demand for energy in which oil has a major role to play. Thus the recently publicized report of the O.E.E.C. Energy Advisory Commission forecasts for Western Europe a 1965 demand for oil products equivalent to 200/240 million tons of crude oil compared with about 157 million tons in 1959. The total demand for oil in all countries of the free world in 1965 is currently estimated to increase above that in 1959 by more than 300 million tons, or, say, 35%. The oil industry, granted freedom of international trade, should therefore continue to enjoy confidence as a growth industry and we are well placed to participate in this growth.

by Hon. M. R. Bridgeman
Chairman, British Petroleum Co.

The difficulties of arriving at a fair basis for international proration, taking into account all the relevant factors, would appear to be so great that it is difficult to see how such a system could, from a practical point of view, be worked out in such a way as to safeguard the interests of producers and consumers alike.

There is also the risk that any such arrangement would tend to impede, rather than assist, the natural development of the use of oil as an efficient and relatively cheap source of energy, and would impair the flexibility of the oil industry in its proved ability to supply the fluctuating but increasing needs of consumers, both in quantity and quality.

by L. F. McCollum
President, Continental Oil Co.

You are to be commended for sponsoring a symposium on (1) the probable duration of the current oversupply of crude oil in the world petroleum markets and (2) international proration of crude oil production as one of the possible means of solving the problem. The many problems involved in connection with these two questions are quite complex. Much too often they are misinterpreted and misunderstood. An oil journal of your excellent standing can perform a real service in directing the thinking on these pressing subjects on the part of the consumers in this country and abroad, governments of oil exporting nations and, perhaps, of the world oil industry itself, into economically sound and realistic channels. For this reason I am delighted to express my views to you in the earnest hope that they will contribute to constructive thinking.

I should like to start my comments by combatting vigorously the attitude of hopelessness with regard to the future of the world petroleum industry. This attitude seems to have been developed in many quar-

T. S. Petersen

M. J. Rathbone

Augustus C. Long

ters all of a sudden when excess crude oil productive capacity became apparent. It is not generally realized that the condition of oversupply is not peculiar to the oil industry alone. For some time overcapacity has existed in many basic raw materials. Over a span of 20 years from 1937 to 1957, the output of no less than 12 major raw materials increased from two to five times, while total world manufactured production during the same period hardly doubled. Most of the excess productive capacities were built up following the hostilities in Korea. The crisis taxed the then existing capacities in many raw materials other than oil. But by 1953 capacities were built up beyond actual needs and increased supplies have been exerting a depressing influence on world raw material prices.

Many of us in this country have been so preoccupied with inflationary trends, which were, and still may be, of primary importance, that we did not pay too much attention to the down drift in world raw material prices. The extent of this decline may be a surprise to many of your readers, because it is only recently that this matter has been clearly and fully analyzed. The Federal Reserve Bank of New York has done a good job on it in its monthly letters.

Admittedly, right at the moment world-wide crude oil productive capacity, particularly in the Middle East, may exceed current demands by a relatively greater margin than is the case with some of the other raw materials. But few, if any, raw materials have a rate of growth in demand which can match the petroleum industry. Industrial countries of Western Europe, the United Kingdom and some of the British Dominions will probably go through the same cycle which this country has already completed. The cycle includes conversion from coal to oil for industrial, railroad, and home heating purposes. All of this is superimposesd on the normal growth in demand for liquid fuels as a propellant for automobile and plane engines.

I hesitate to make a guess as to a specific period of time during which a condition of oversupply of crude oil could last. I am glad to notice, however, that such predictions as have been published on this subject are becoming more optimistic as time goes on. The earliest predictions put the duration of oversupply at ten years or more. The latest forecast which I have seen narrowed the time to three years.

The change in sentiment is largely attributable to a better understanding of the problem. The opinion has become fashionable, particularly among certain observers outside of the oil industry, that prolific oil reserves can be found in almost any part of the world at low cost and practically at no risk. It is gradually giving way to a more sober and realistic attitude. To me who has been searching for oil, since the start of my business career, the unusually large increase in productive capacity in recent years is an anomaly. It is not a continuing and lasting situation. Moreover, the expansion in crude oil reserves has not happened either instantaneously or in widely dispersed areas. From 1952 to 1959 Free World crude reserves increased from 109.0 million barrels to 261.1 billion barrels. But about 2/3 of the increase was accounted for by the Middle East (Kuwait, Iran, Iraq and Saudi Arabia). The only new major areas discovered that have any promise of being comparable to the Persian Gulf producing areas, are Libya and, to a lesser extent, Algeria. No significant new oil reserves have been discovered in any other parts of the world despite intensive search. The intensity of the search and fierce competition for new concessions are caused primarily by the oil companies' desire to diversify their sources of crude supply and spread the risks. When viewed objectively, these activities give very little support to the thought that the present oversupply is believed to be of long lasting duration.

For the near future I am not so much concerned with oversupply of crude as with magnitude of the task of providing discoveries and availability of additional volumes of crude oil to satisfy growing demand. During the next few years these increments in demand will amount to more than a million barrels per day. I think that we should not fail to recognize the Herculean task which we are facing in a world where petroleum continues to be both indispensable and quite difficult to find.

Now let me discuss your second question dealing with the possibilities of world-wide proration of crude oil production. The assumption now widely accepted is that international proration is unlikely to become an actuality. The most plausible reason advanced in support of this assumption is that the viewpoints and interests of the oil exporting countries are widely divergent. Consequently, it would be impossible to have all the oil producing countries adopt uniform proration rules.

I believe that undue complacency on this subject on our part is quite dangerous. All oil exporting countries have one interest in common: to increase their revenues from oil operations. In the past this aim has been achieved through (1) increasing production volumes from already existing concessions, (2) expanding the host government's share of the oil companies' profits, and (3) granting new concessions to newcomers. Usually one of these means at a time was sufficient to bring the desired results. However, in the last few years the Venezuelan government applied all three means in rapid succession, and yet, government revenues from oil operations have shown a continuing and alarming decline.

This experience caused a profound change in the thinking of Venezuelan government officials. Dr. Juan Perez Alfonzo, Venezuela's oil Minister, has repeatedly stressed that he is more concerned with maintaining the prices for Venezuelan oil than with expanding production. He is actively pressing for international proration, together with Sheikh Abdullah H. Tariki, Director of Petroleum and Mineral Affairs of Saudi Arabia.

Venezuela came under strong adverse economic pressures earlier than the Middle East. Most of the major Middle Eastern producers are still thinking in terms of higher production volumes and a higher take of oil companies' profits as a way of increasing revenues. However, if adverse economic pressures on Middle Eastern producers should increase to a point where orthodox methods of expanding oil revenues are no longer effective, some sort of a proration scheme may be ultimately accepted.

If these events should come to pass, privately owned oil companies with operations beyond the borders of their countries will be faced with a vicious situation. The international proration scheme which is advocated by Venezuela and Saudi Arabia contemplates a consortium of governments of oil exporting countries, rather than a cartel of the foreign producing companies. All of the many previous efforts to restrict production of various raw materials to existing demand through the instrumentality of international cartels invariably failed. One of the reasons for such failure was the fact that while cartel agreements were reached initially among individual producing companies, governments of the countries concerned ultimately stepped in to enforce the agreements. The U. S. government, because of its traditional anti-trust policy, was a notorious exception.

In a consortium of oil exporting countries, if it is ever organized for the purpose of enforcing international proration, producing companies probably will have no voice or standing. But just the same they will be faced with the task of battling, in the consortium or more likely outside of it, sovereign governments which will impose producing quotas without much regard to volumes that can be actually sold.

In my opinion a conclusion that international proration may work because proration by state conservation bodies in this country proved to be reasonably successful is utterly fallacious. In this country there are thousands of producers of crude oil who are not integrated and who have no knowledge or appreciation of frequent changes in market demand for their output. By contrast, abroad, and particularly in the Middle East, there are relatively few producers. Until recently all of them were fully integrated companies. They channeled their output through their own refineries into markets which have been painstakingly built up over a period of years.

It is hard to imagine that a well managed integrated company will consistently produce more oil than it expects to sell through its own outlets or on a contractual basis. There probably is more temptation for a nonintegrated company, which lacks full knowledge on existing markets, to overproduce. This is what at least some of the newcomers into the international oil industry have done after discovering and developing new production.

My final conclusion is that remedial action to establish orderly markets for foreign crude production does not lie in internation proration promulgated by governments of oil exporting nations. The solution is in the hands of the oil companies themselves. It calls for greater integration of all petroleum activities (i.e. production, transportation, manufacturing and marketing) on an international scale. At the very least it calls for development of specific markets simultaneously with the development of crude oil production. The unfounded hope that foreign crude oil produced in excess of existing markets, or markets in the process of being created, can be sold by some miracle has to be abandoned. If this is done and the companies operating in the international scene, both large and small, adjust their production to actual and not imaginary markets, the problem of ever-supply will be solved.

by H. Wilkinson, C.M.G.
A Managing Director of the Royal Dutch/Shell Group of Companies

If one is asked to comment on what is often referred to as the present over-supply of crude, the first point to be made is that there is not actually any large over-supply of oil products delivered to the market, although it is true that current surplus crude potentials are having a psychological effect out of proportion to their real significance. What has occurred is that this potential producing capacity has been built up at a somewhat faster rate than the current rate of increase in consumption.

Since new supplies normally take many years to find and more years to develop, it is obvious that these processes must be undertaken long before the time of delivery. In the decade 1950-1960, the rate of world consumption was increasing so rapidly that there were fears that production potentials could not be brought up in time to cope with it. The industry's efforts were so successful, however, both in developing new sources and in increasing both transport and refining capacity, that a temporary hump has been built up. A number of new suppliers who were attracted by scarcity conditions now find themselves with surplus potentials which they are anxious to place on the market to re-coup themselves, e.g. for money which they borrowed as part of their gamble. While the quantities involved are not likely to be significant in relation to world supply and demand they do, of course, have a temporary depressive effect on prices.

Into this picture is injected the current complication of Russian supplies which, though they may or may not really be surplus to the needs of Russia's own expansion of internal economy, the Soviets currently are willing to offer on the international market either for economic or other reasons. Many people will remember the Russian policy in the 1920 and 1930's of selling cut-price oil products in Europe, but those who began to depend on these supplies were disillusioned, because they were withdrawn from the market when the Soviet Union, for doubtless quite logical reasons, decided to give priority to its own home needs for oil consumption.

While some consumers may be tempted to pick up low-priced supplies, I think the majority of responsible customers will want to assure themselves both of continuity of supply free of any political considerations, and the consistency of quality and service to which they have become accustomed.

If one is asked how long this excess-potential situation is likely to go on, I am afraid one must counter the question by asking for a guess as to how long oil is going to be sold on an uneconomic basis.

Oilfields by nature are a wasting asset; that is, they have got to be replaced before they run out, and anyone who sells oil below replacement costs is either doing so to cut his losses when he has burnt his fingers —in which case he will not do it again— or because he is prepared for other reasons to divert economic resources to subsidize oil consumption artificially. If the latter consideration is left out of account (and I would emphasize our deep conviction that oil companies should not engage in politics) then it must be only a question of time before rising world demand catches up with the overbuilding of production and refining capacity to which I have referred.

Estimating this time depends on a great many complex and variable factors and ultimately comes down to the exercise of business judgement as to when a company will have to start expanding its own facilities again to keep up with the demand. I am not prepared to make a public guess at this time. However, it is pertinent to remember that all estimates that can be made show that by as early as 1970, even with the best efforts at increasing domestic reserves, the United States is expected to have to increase its net oil imports by about 66%, and in Europe, which represents the most intensive consuming area in the world, consumption is expected to have increased by over 80%.

As regards our reaction to ideas that have been mooted by certain producing countries regarding their introducing a restriction of production by inter-governmental agreement, there are of course political aspects of this which are outside our province. But it would have an economic effect on the oil industry which it is our duty to assess.

The temptation to apply artificial controls when natural economic adjustments are causing inconvenience is quite understandable, and the situation is in some ways similar to what occurred when unsuccessful attempts were made in the depths of the 1930 depression to "rationalize" production. People might also think that companies like ours would want to support action aimed at maintaining higher prices and larger profits as a reward for the risks we have taken. If we, however, have learned one lesson from experience it is that competition—and by that I mean commercial competition free from political angles—is not only better for both companies and governments in the long run but it is in fact the only sure guide to economic prosperity generally. It is difficult to imagine how any oil producing country would wish to forego opportunities for increasing its own prosperity, nor, for that matter, would consuming countries stand idly by and see their energy costs raised by the action of a group of producers, whether private or governmental. One inevitable result would be an immediate stimulation of other forms of energy. Not only would this mean higher energy costs for the consumer, but the oil producing countries would suffer from a loss of outlet that might well be permanent. Therefore, whatever some people may think about the theoretical advantages of international proration aiming at higher prices, it seems that the situation referred to is not particularly likely to happen.

by E. L. Steiniger
President, Sinclair Oil Corp.

The major producing countries—Kuwait, Iran, Saudi Arabia, the United States and Venezuela are capable of producing a minimum additional 7,000,000b/d from present developed and underdeveloped reserves. New reserves will undoubtedly be discovered in these countries which, with the development of production in Libya, the Sahara and increased production in Canada, Brazil, Argentina and Columbia, and additional minimum 5,000,000 b/d would appear to be available within the next few years.

Consumption of the free world countries, however, is not increasing at as great a rate, hence, it would appear that we will have a substantial, although gradually diminishing, surplus of crude available for at least the next ten years.

The proposals to curtail or apportion production by nations do not seem at all realistic as the new producing areas and those being developed, such as Libya, Sahara, Argentina and Brazil, could not agree to a curtailment of production for economic and political reasons. Aside from the need of supplying their own requirements, some countries feel an absolute necessity of acquiring a share of the big and greatly increasing European market.

I believe, nevertheless, that the producers of crude will adhere more and more to the law of supply and demand and thereby, keeping production within reasonable bounds, avoiding excessive production to the end of greatly reducing or eliminating any serious threat to the soundness of the oil business.

by A. L. Nickerson,
President, Socony Mobil Oil Co., Inc.

In response to your request for comments on the international competition for crude markets, I hesitate to offer specific predictions or opinions on the topics you mention. I would, however, like to point out one development that has, to my knowledge, re-

ceived little attention in this country. During the first quarter of 1960, demand for petroleum products in Europe rose by some 15% above the corresponding quarter of last year, a rise that was reflected to a large extent throughout the free foreign area. Such an increase is far greater than has been expected.

Although it would obviously be unwise to project that demand increase beyond the first quarter, I feel the figure has some significance—particularly at a time when oil men are so concerned about supply conditions around the world.

by T. S. Petersen
President, Standard Oil Co. of Calif.

I do not believe that the present situation of excessive supplies and distressed prices will continue much past the middle 1960s, with earlier improvement a possibility on the domestic scene. It appears that reduced financial incentives of today will curb foreign oil investments somewhat and thus reduce exploration for and development of reserves. Couple this trend with a yearly increase in worldwide demand of more than one million barrels a day and the industry's outlook is for better balance and stability than it presently enjoys.

On the subject of world proration, it seems unlikely that the degree of cooperation between nations necessary for the success of such a plan is attainable, at least in our time. Too many varying interests are involved in a complex and competitive industry to permit creation of what would amount to international control of oil by inter-government cartel.

by M. J. Rathbone
President, Standard Oil Co. (N. J.)

Barring some unforeseen development, conditions of abundant or over-abundant supply are likely to be with us for some years to come. This is, of course, a different situation than that which faced the industry during most of the post-war period. Capacity more than adequate for present requirements now exists in all branches of the industry. There is a particularly great excess in crude producibility resulting from the marked success in oil finding in many parts of the world over the last few years. This is a factor which could not be predicted or controlled.

There are certain things than can be done to improve consumption of oil, and a great deal of promising work is already being carried out on development of new oil uses. Equally important, present markets must be held and their growth encouraged.

On the supply side, normal functioning of the natural economic processes should gradually bring industry activities in better balance. Investments in new facilities and projects are being closely scrutinized in the industry generally to determine if the capacity they will provide can be economically employed under present conditions. Marginal projects are now less likely to be undertaken.

It is important to remember that there are no panacaeas which will correct the industry's present difficulties. Certainly the solution cannot be found in government action. International proration as a means of stabilizing prices would work to the detriment of the very producing countries from which the suggestion has originated. Attempts to carry out such a scheme could only result in loss of markets to non-prorated production or substitute sources of energy. Oil has risen to its present position as one of the world's leading industries through the system of free competition, and its continued growth is best assured on the same basis.

Periods such as the present have been experienced at various times throughout oil's history, and there is no reason for pessimism as to the long-range future. The industry can still look forward to continued growth. This alone is a powerful factor in absorbing excess capacity.

by Augustus C. Long
Chairman of the Board, Texaco, Inc.

In recent months considerable distress has been voiced over what has been characterized as a "flood of oil" and resulting "chaotic marketing conditions" in the petroleum industry. We feel such statements greatly exaggerate the existing situation and we see no real basis for either pessimism or gloom.

Productive capacity in the world today is somewhat more than ample to cover present requirements, but there is no "flood" of oil. It seems to us much better to have a plentiful supply of oil than not enough. Learning to live with abundance is clearly preferable to facing a future of want—of waning sources of energy and depleted reserves.

There is every reason to believe a satisfactory adjustment is being made between supply and the continually increasing demand. The present phase of adjustment is to be expected in an industry as intensely competitive as petroleum. The desired balance can best be achieved by companies in the industry individually determining, as they always have in the past, what action is required on their part.

In this respect there is little difference between the oil man and the producer of steel, automobiles, shoes or breakfast cereal. The free market economy in all of these private industries is fully capable of adjusting to fluctuations of supply and demand, but like any finely attuned mechanism it must be dealt with promptly and prudently.

The steel industry, for example, with its present productive capacity, could easily mine and refine its ample reserves of iron ore far in excess of market demand. The automobile industry can—and has—produced many more cars than can be sold. The manufacturer of shoes or cereal could do likewise.

But, to do so could scarcely be called an act of prudence. Any industry that consciously flaunts the dictates of the free market may expect to reap the economic consequences. In the past when businessmen have committed errors of judgment, careful attention of the requirements of the market has almost always resulted in satisfactory marketing conditions being re-established.

This holds true today. The petroleum industry is now more than a century old, and has served its economic apprenticeship. By this time, the industry should be able to pursue its normal function of service to the community without alternating between panic and complacency.

By the chief executive officer of a major international oil company

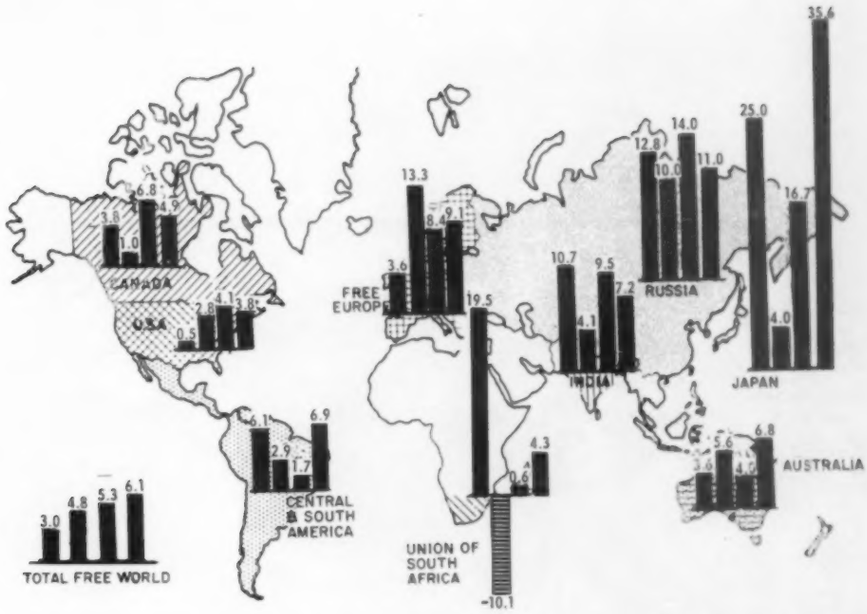
Today a significant surplus of crude production capacity exists in the United States and in the balance of the Free World. Additional producing countries and development of capacity by companies not previously established in Free World production outside the United States have placed pressure on the movement of new supplies into old markets. This situation has been accentuated by growth of Russian exports and desire for increased revenue on the part of underdeveloped nations.

Even though Free World demand can be expetced to grow at an annual compounded rate of 5 to 6% over the next decade, it is probable that production capacity will still exceed demand by a significant margin at the end of the period. During the next ten years adjustments will be made to accommodate production from newcomers. Initially, these adjustments will produce some competitive excesses. However, these pressures will be modified by the constant growth in demand which by 1965 should have added some 6,000,000 b/d to the Free World total. Communist Bloc internal requirements will expand rapidly. Most of the surplus production capacity is in the strong hands of well established American and European companies which will not be forced to unwise practices by financial necessity. In my opinion, the second half of the decade should witness increasing stability induced by wider understanding and acceptance of economic facts.

Pro-ration to market demand is possible in the United States because of the Connally Act. There is no comparable method of restraint available to international groups. In the past, efforts to organize international restraint on production of surplus commodities have ended in dismal failure because the conscientious participants lost out. Determination of allowable production by countries according to some arbitrary standard based on wells and reserves would create a gigantic administrative problem. A prerequisite would be a central intelligence capable of digesting the mountains of technical data and ruling on it with unquestioned integrity. I do not know how such a central intelligence could be created.

If producing countries would face the realities of the situation and develop mutual confidence and respect with their con-

(*Continued on page* 98)



Trends in petroleum consumption, showing year-to-year percentage changes during 1957, 1958, 1959 and 1960. Change in 1957 is shown in column at left, followed by successive years with the right-hand column in all cases representing the estimated 1960 change.

World oil demand in 1960 will be nearly 22 million barrels daily

Continued strong industrial growth in Eastern hemisphere will bring 6.8% increase this year. Europe maintains high rate.

WORLD DEMAND FOR PETROLEUM is expected to rise 1,377,600 barrels per day this year, to a level of 21,682,500 daily barrels, according to estimates developed by WORLD PETROLEUM on the basis of available world-wide consumption data.

This anticipated 6.8% increase compares with a growth in demand of 6.9%, or 1,316,000 b/d in 1959, and with 5.1%, or 985,000 b/d in 1958.

Early reports on actual consumption for the first few months of 1960 would seem to point towards even higher rates of increase than the forecasts. However, most industry economists feel the trend curves will tend to level out to the estimated forecasts shown above.

For example, preliminary returns on consumption in the first quarter of this year indicate that the non-Communist world product demand in the western half of the eastern hemisphere is running about 18% over the same period in 1959. This is almost 9% above the predicted daily average for Europe, Africa, and the Middle East. Correspondingly, for parts of Asia, the Far East and Oceania, first quarter 1960 demand is running about 11.5% above the first quarter of 1959, or some 2% above forecasts.

The point to bear in mind is that quarterly data generally give only a limited indication for an entire year. Two factors which are affecting growth in specific areas are (1) the rise in fuel oil demand in Europe, and (2) the increase in bunker fuels in Japan.

The Eastern hemisphere continues to rise at a more rapid rate than the western hemisphere. (See Table 1.) The anticipated increase in demand of 10.1% this year for the eastern half of the world is more than double the 4.4% expected in the west. Although the eastern hemisphere rise is from a smaller base, the differential grows less every year. For example, this year 43.5% of the total world demand for petroleum is in the eastern hemisphere. Last year it was 41.2%, and in 1949 it was 29.5%.

Latin America and Canada are expected to increase consumption at greater rates than the United States within the western hemisphere. With Argentina, Brazil, and Chile continuing to show strong growth rates, the countries of Latin America will maintain the 7.3% demand rise they indicated last year. Canada will probably show

TABLE 1—ESTIMATED WORLD CONSUMPTION OF PETROLEUM PRODUCTS

(Crude-Equivalent Basis,* 1,000 b/d)

	1959	1960	% Increase
Alaska and Hawaii	50.0	52.0	4.0
Canada	809.9	850.0	4.9
United States	9,435.5	9,796.0	3.8
Mexico	263.9	278.0	5.2
TOTAL NORTH AMERICA	**10,559.3**	**10,976.0**	**3.9**
Argentina	237.0	269.3	13.6
Bermuda	3.3	3.4	3.0
Bolivia	5.6	6.0	8.0
Brazil	236.0	250.0	6.0
Chile	43.0	47.3	10.0
Colombia	50.0	54.0	8.0
Costa Rica	3.1	3.2	5.0
Cuba	83.6	83.6	—
Dominican Republic	5.6	5.7	2.0
Ecuador	10.3	10.5	5.0
El Salvador	3.6	3.8	5.0
Guatemala	9.1	9.6	5.1
Guianas	6.4	6.9	8.0
Haiti	1.6	1.7	7.0
Honduras	3.1	3.3	6.5
Jamaica	14.6	15.4	5.9
Netherlands Antilles	141.8	142.5	0.5
Nicaragua	3.0	3.2	6.7
Panama	21.9	22.7	3.7
Paraguay	1.8	1.9	5.5
Peru	42.4	46.0	8.5
Puerto Rico	47.4	51.0	7.5
Trinidad and Tobago	45.6	46.4	1.7
Uruguay	27.8	29.0	4.2
Venezuela	133.1	138.0	3.7
TOTAL SO. AMERICA & CARIBBEAN	**1,240.0**	**1,330.0**	**7.3**
TOTAL WESTERN HEMISPHERE	**11,799.3**	**12,306.0**	**4.4**
Austria	50.1	56.3	12.3
Belgium & Luxembourg	139.0	147.6	6.2
Denmark	97.0	107.5	10.8
Finland	42.0	46.2	10.0
France	496.2	541.4	9.1
Germany (Western)	534.5	620.0	18.0
Gibraltar	10.4	11.1	6.7
Greece	43.6	47.0	7.8
Iceland	7.7	8.0	3.9
Ireland (Eire)	25.1	26.4	5.2
Italy	341.0	371.9	9.0
Netherlands	230.7	257.5	11.9
Norway	71.7	77.2	7.7
Portugal & Islands	28.4	29.9	5.3
Spain	103.2	114.8	11.3
Sweden	238.0	252.0	5.9
Switzerland	72.0	80.3	11.5
United Kingdom	795.5	864.0	8.6
Yugoslavia	24.8	26.8	8.2
USSR and Bloc	2,700.0	3,000.0	11.0
TOTAL EUROPE	**6,093.8**	**6,710.0**	**10.0**

	1959	1960	% Increase
Algeria	37.0	39.5	6.7
Angola	4.1	4.1	—
British West Africa	16.8	18.5	9.8
Canary Islands	59.2	60.0	1.3
Congo	9.4	9.8	4.0
Ethiopia, Eritrea, Somaliland	18.2	19.3	6.1
Egypt (UAR)	85.4	90.5	6.0
East Africa	25.8	27.1	5.0
French West Africa	11.2	11.8	5.4
Ghana	9.9	10.3	4.0
Libya	4.9	5.9	20.3
Morocco	15.3	16.0	4.6
Nigeria	16.0	16.3	1.9
Portuguese West Africa	13.3	14.0	5.6
South Africa	99.2	103.5	4.3
Sudan	9.3	9.9	6.5
Tunisia	9.8	11.0	1.2
TOTAL AFRICA	**480.0**	**507.5**	**5.7**
Aden	70.5	71.5	1.4
Bahrain	25.4	26.3	3.5
Iran	134.0	144.0	7.5
Iraq	35.8	38.3	7.0
Israel	37.7	40.7	7.9
Jordan	4.2	4.4	4.8
Kuwait	99.8	110.7	10.9
Lebanon	17.1	18.5	8.2
Neutral Zone	9.8	10.0	2.0
Saudi Arabia	44.4	45.1	1.6
Syria (UAR)	17.0	17.7	4.1
Turkey	43.0	47.2	9.8
TOTAL MIDDLE EAST	**542.8**	**579.0**	**6.7**
Australia	211.0	225.2	6.8
British Borneo	11.5	12.2	7.8
Burma	11.0	12.3	6.4
Ceylon	21.0	22.1	5.2
China	90.0	95.0	5.0
Hong Kong	23.1	24.6	6.5
India	148.9	159.6	7.2
Indonesia	86.5	94.3	9.0
Japan	370.3	503.2	35.6
Korea, South	21.4	20.0	—6.5
Malaya	70.4	74.2	5.4
New Zealand	38.9	41.4	6.4
Pakistan	46.4	47.3	1.9
Philippines	55.2	61.2	10.8
Thailand	23.2	25.6	9.9
Taiwan	30.6	31.1	1.6
Vietnam, Laos, Cambodia	15.8	17.2	8.8
TOTAL FAR EAST & OCEANIA	**1,389.0**	**1,580.0**	**13.7**
TOTAL EASTERN HEMISPHERE	**8,505.6**	**9,376.5**	**10.2**
TOTAL WORLD	**20,304.9**	**21,682.5**	**6.8**

*Includes natural gas liquids and refining and marketing losses. Estimates of military liftings are not shown as domestic consumption in some countries, but are included in area and world totals, hence totals are greater than the sum of items shown.

TABLE 2—FLOW OF CRUDE OIL AND FINISHED PRODUCTS, 1959

(in 1,000 b/d)

To: / From:	Canada	Mexico	USA	Ven/ NWA	Lat Amer	Europe	Africa	M.E.	F.E.	Comm. Areas
Canada	—	—	42	256	9	—	—	103	—	—
Mexico	—	—	24	—	—	—	—	—	—	—
U.S.A.	97	36	—	1,131	113	3	—	334	65	—
Venezuela/NWA	—	—	5	—	31	—	—	—	—	—
Other Latin America	—	—	15	588	—	—	—	75	—	22
Europe	—	—	50	498	108	—	80	2,622	9	242
Africa	—	—	12	81	6	113	—	198	—	39
Middle East	—	—	3	—	—	30	—	—	—	—
Far East	—	—	60	2	—	2	—	787	—	2
Free World	97	36	1,990	2,556	267	148	80	4,119	74	305

a 4.9% increase, while the USA is expected to rise only 3.8%, less than it rose in 1959. Continental USA demand will still fall short of 10 million barrels daily in 1960, being projected at 9,796,000 b/d.

The eastern hemisphere will be highlighted by rather healthy increases in growth rates in the Far East and Africa, a moderate increase in rate in the Middle East, and a continued strong rise in Europe.

Western Europe demand will probably reach 3.7 million b/d, an increase of about 316,000 b/d or 9.4%; while Communist nations expect a rise of some 11%, to 3 million b/d demand in 1960.

Indications are strong that the United Kingdom will replace Canada as the third largest consuming country, after the USA and the USSR and bloc, with its projected 1960 demand level of 864,000 b/d. Fuel oil consumption continues to be the dominant factor in this UK rise.

If the spectacular first quarter actual consumption in Western Europe could be taken for any kind of an indication, an assumption could be made that 1960 increases would be still greater. Inland consumption, excluding refinery use, during January-March of this year for the four largest consuming countries was up about 25%. In the U.K. the rate was 21% higher, in Italy 28%, and in West Germany the increase was an astonishing 44%. These figures however, resulted from a number of causes: a continuation of a heavy growth during the last few months of 1959, and additions to stocks in anticipation of tax increases on motor fuels and fuel oils in the case of Germany.

Largest increase in demand in Europe is predicted for Germany, 18%, or about 85,500 b/d, to 620,000 b/d this year. Germany will therefore replace France as the largest consumer in continental Europe. French demand is expected to rise about 9%, to 541,400 b/d.

There are, in fact, no signs of a downturn in growth anywhere in Europe this year. Even those nations with the lowest increases, a little over 5%, are all higher than the United States.

East of Europe, the demand situation is dominated by the very great growth in Japan, where consumption is expected to reach 503,200 b/d this year, for a rise of 35.6%. Largely because of this, but also due to very healthy increases in Australia, the Philippines, India, Indoneasia, and Thailand, the Far Eastern section of the world will show an expected 13.7% increase in demand.

A number of interesting changes have been taking place in the world consumption pattern during the past few years, as illus-

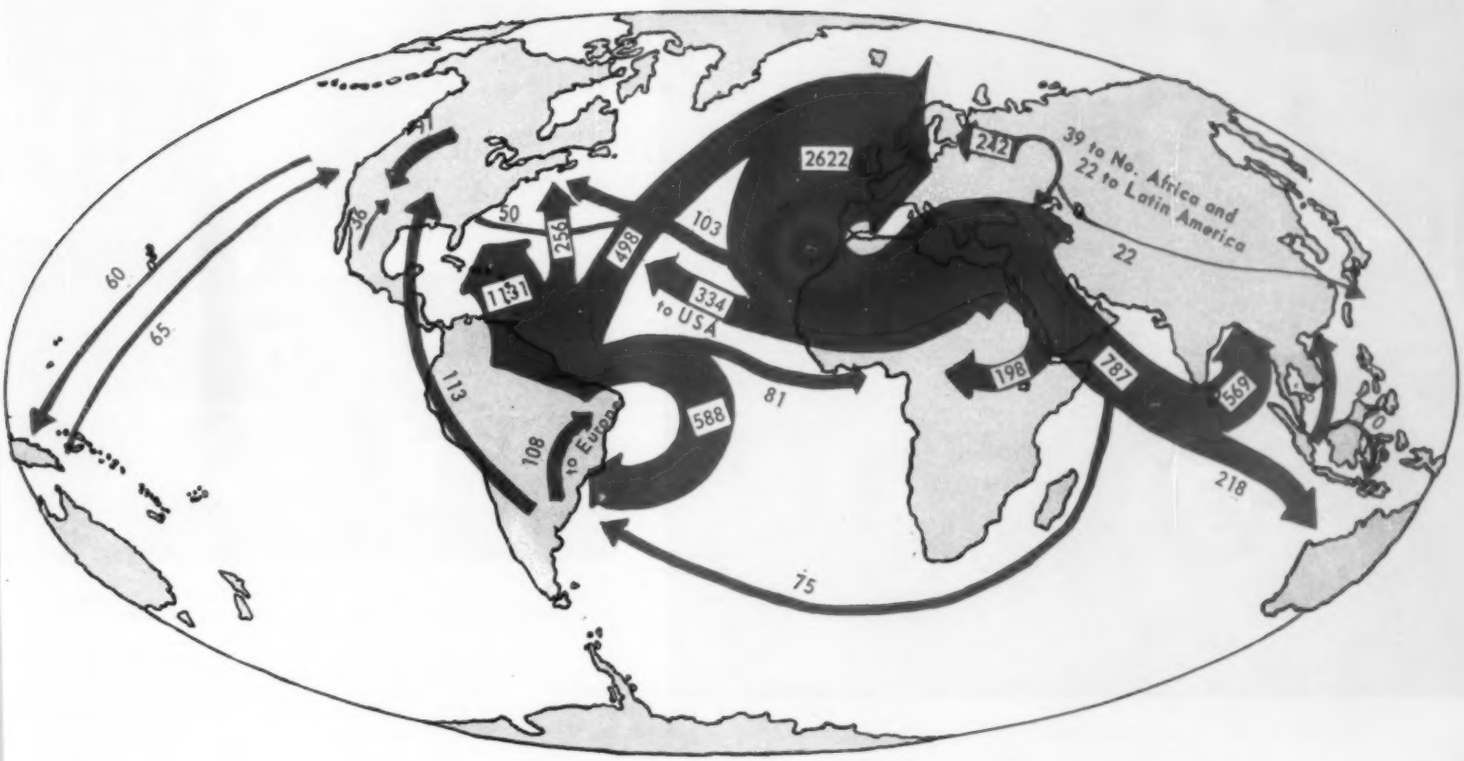


Chart indicating principal intercontinental flow of petroleum and products during 1959. Figures show approximate shipments in 1000 b/d. Arrows are not intended to indicate route followed—only origin and destination continents.

trated in the chart on page 45, which shows the year-to-year changes in demand for a number of selected areas. This chart has been based upon a similar one developed by H. W. McCobb, vice president, Standard Vacuum Oil Co., in his paper "Review of Foreign Oil Production in 1959," at the annual meeting of the American Institute of Mining, Metallurgical and Petroleum Engineers last February; the 1959 and 1960 data having been brought up to date.

In several areas—Canada, India, and Japan—the 1958 recession was the major factor affecting demand in the years shown. The Suez crisis also had significance during some of these years; for example the low increase in consumption in Europe from 1956 to 1957, and then the abnormally large increase after the Suez crisis. There has also been a steadily increasing shift from coal to oil in Europe accounting for the rise in consumption.

South America's big increase in 1957 was due to the shift of bunkering from Europe to this area during Suez. And South Africa likewise shows the effects of shifts in bunkering.

Overall, and outside the USA, a good yearly increase in demand is to be expected because of the rapid rate of industrialization and the population explosion.

Of all the shifts, however, perhaps the most far-reaching in potential effect has been the movement of Russian oil into the world market.

In 1959, the Soviet bloc exported 290,000 barrels daily of crude and products to the free world. Of this, 100,000 b/d was crude petroleum and the remaining 190,000 was product. This represented about 10% of 1959 production by Communist countries, and compares with a 1958 average of 220,000 b/d.

Most of these exports went to Western Europe and the Scandinavian countries—215,000 b/d. About 25,000 b/d were shipped to South America, largely on barter arrangements, and Japan received 2,000 b/d. It is probably of especial interest to note that 2,000 b/d were shipped to the USA in the form of Russian benzene, presumably for petrochemicals.

In addition to these actual exports, the USSR has been active in several parts of the free world trying to develop barter deals for its oil, and at very low per barrel prices.

A notable success for Russia has been with Cuba in a crude oil for sugar trade deal. The Cuban government took over the three largest refineries, totaling some 82,000 b/d of capacity when the USA and British owners refused to accept the 300,000 ton of Russian crude oil resulting from the trade agreement.

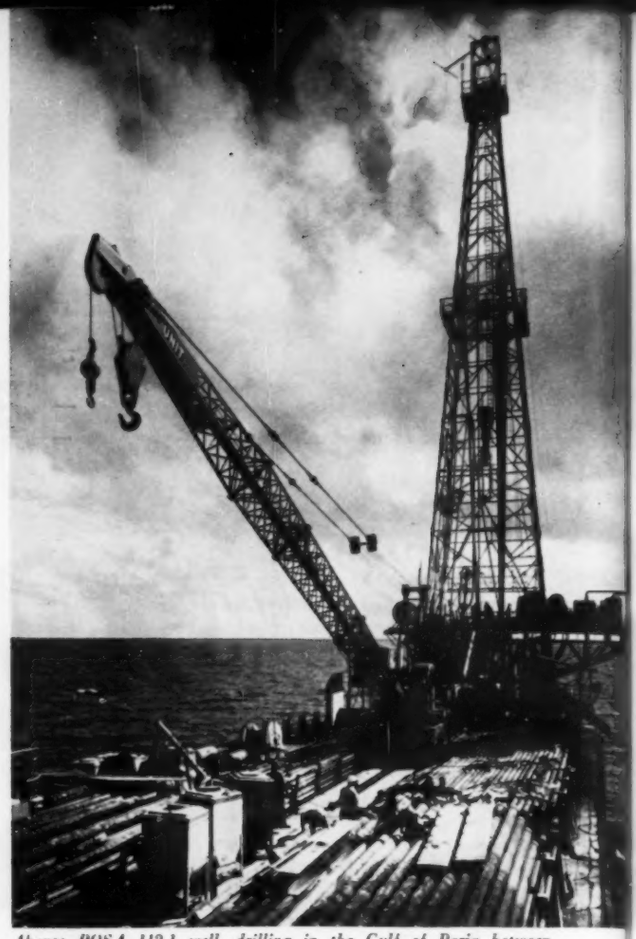
By the end of August, a total of 3.6 million bbl of Russian oil, at $2.14/bbl delivered cost, will have been laid down in Cuba. The three refineries were reported to be running about 64,000 b/d of the oil.

In Brazil, the USSR has a three-year trade pact which includes purchase by Brazil of $20 million worth of oil and oil field equipment this year in exchange for coffee.

A further discussion of the impact of the USSR oil activities on the world market is given in another article in this issue.

The principal intercontinental flow of crude oil and petroleum products during 1959 is shown in the accompanying chart. Table 2 provides a bit more detail on imports to several areas. Figures give approximate shipments in thousand barrels daily.

END



Above: POSA 112-1 well, drilling in the Gulf of Paria between Venezuela and Trinidad. Ohio Oil Co. holds 25%, Texas Co. has 25%, Continental Oil 25%, Cities Service Co. 16 2/3%, and Richfield Oil Corp. 8 1/3% in Paria Operations, Inc.

Left: The 142 foot mast of The Ohio Oil Co. of Guatemala's Chinaja No. 1 well dwarfs the rain forest in the isolated Peten region. Photograph is by Gey Gruner, courtesy of The Ohio Oil Co.

World's wildcats reviewed

THE FOCAL POINT of the world's oil exploration continues to be Africa, where the world's last major exploratory discovery has been made in the vast Saharan regions of Algeria and Libya. Not far behind is the Middle East, especially the offshore area which has now raised the number of its oil fields to three, including the world's largest offshore field found to date. Europe is striving to increase its domestic supplies, and a series of small finds have been made, profitable mostly because of their proximity to market and position within the Common Market tariff wall.

In the Western Hemisphere, activity is high at the two extremes. Alaska's oil play is heating up and Argentina's is gaining steam rapidly with a new extension to the contracts there. Central America has slowed its pace for the moment, with disappointments in Guatemala dampening enthusiasm in neighboring countries as well. The Castro regime is trying its hand at oil exploration now, and soon will begin a 12,000-ft well in Cuba. These and other developments are summarized in the following review.

Asia and Australasia

Australia—Activity is picking up slowly. No discoveries have been made yet on a commercial scale, but exploration is still in its infancy. An encouraging sign was a discovery by Australian Oilfields N.L., an Australian company with no overseas affiliates, which on April 4, 1960 completed a gas well producing at about 1.25 million cubic feet daily at Timbury Hills, near Roma in Queensland.

The principal drilling company continues to be WAPET, which is expected to transfer its activities back to the Rough Range area after drilling a series of dry holes elsewhere in West Australia.

British Borneo—Exploration was to have been continued offshore after arrival of the Adma Enterprise, an offshore movable platform. Mechanical troubles have delayed the start of exploration, it is reported.

Burma—Burma Oil Co. (1954) Ltd. is using two company rigs on exploration and one contract rig operated by Santa Fe Drilling Co. No oil finds have been reported.

India—Interest in this area, one of the large crude markets of Asia, has heightened with passage of new regulations. The government has eight rigs active, being operated by Romanian and Russian contractors. Standard Vacuum is still exploring, although no discovery has been made as yet, and Oil India Ltd. is using four rigs.

Indonesia—Seven rigs are active, two each by Caltex and Standard Vacuum and

three by Shell. All are believed to be company rigs. No discoveries are reported.

Japan—Fifteen rigs are working, several of them offshore where a discovery was reported early in 1960. Japan Petroleum Exploration Co., Ltd., is the principal explorer and two contractors are working for the company.

New Guinea (West) — The operating company, partly owned by Standard Vacuum, has one rig operating but no exploratory work is being done.

New Zealand—A Shell/BP/Todd Bros. consortium is drilling an exploratory well. A discovery was reported early in 1960.

Pakistan—Standard Vacuum Oil Co. is using a contractor in East Pakistan with one rig, no finds reported. Pakistan Petroleum Co. is also working with a contractor. Nine rigs are running.

Papua—The long oil hunt is drawing to its close and American partners in the search may withdraw their support soon. One rig is working at present, but no positive results have been reported.

Philippines—Three rigs are running, operated by or for Standard Vacuum, Philippine Oil Development, and Acoje Oil Co. No major oil finds have been made as yet. The government has proposed a 27½% depletion allowance as an incentive to investment.

Europe

Austria — RAG, the joint Shell/Mobil company, has reported some activity in Upper Austria where Reid 5 came as a small producer some months ago. Since then exploration by most companies in the country has slowed but may pick up again soon under the new settlement. At present there are 23 rigs operating, of which 20 are company rigs belonging to OeMV, the Austrian government's company. RAG has two company rigs working. Voralberger, a joint government-private company has one contractor, the German company Preussag, working with one rig.

France—A total of 36 rigs were in operation in France, as of 1 July 1960. Of these, 20 were on exploration, the rest on development work. Included were 10 heavy rigs on exploration, nine medium-depth rigs and one light rig. A number of contractors are at work, including Forex, which has two rigs going to SNPA, two for Esso REP and one for CEP.

The Paris Basin continues to be the focal point of exploratory effort. A well 22 miles Southwest of St. Martin de Bossenay field yielded 144 b/d for COPESEP, a company controlled by the Shell Group. Another development well in the Coulommes area, near Paris, came in at 4,000 b/d.

Germany (West)—A total of 105 rigs are operating in Germany and production continues to rise slowly, even though the drilling for deeper production has not yielded encouraging results as yet. In addition to the 105 heavy rotary rigs, 161 shallow rigs are operating. A number of contractors, including Haniel & Lueg; Hermann von Rautenkranz, Internationale; Braunschweigische Bohrgesellschaft; and Ferdinand Koller und Sohn are operating.

Italy (including Sicily)—About 60 rigs are operating in Italy, including 45 company and 15 contract rigs. The great majority are government rigs, operating for the account of ENI and its subsidiaries. Pan American International and Cities Service Oil Co. have a joint venture, however, in the south of Italy and are currently on their second wildcat. The first was abandoned with no shows.

Oil interest in Sicily is waning, and no concessions for exploitation have been granted because of the lack of new discoveries since 1958. British Petroleum's subsidiary, Cisda Oil, renounced its permit over the Vittoria area when the crude there was found too heavy for production. ENI is planning more wells after the second offshore extension of Gela field found oil at 10,240 ft. An offshore barge will be used.

Greece—Considerable interest in exploration has been shown since passage of the new oil law and such companies as British Petroleum, Esso and Shell have applied for or received concessions. A German independent is also exploring, and a recent unconfirmed report indicates that a discovery has been made.

Netherlands — NAM, the sole exploring company, has continued an intensive search and is currently investigating offshore possibilities. No discoveries have been reported in the first nine months of 1960.

Portugal—No exploratory wells are drilling since Mobil pulled out its rig and terminated its joint exploratory campaign with Cia. dos Petroleos, a company controlled by Portuguese government and Swedish private (Johnson interests) capital.

Spain—Seven rigs are actively exploring in Spain, with no discoveries reported. General American, independent company from Texas, has drilled many dry holes in company with the government through VALDEBRO, a joint company, and may abandon its exploration soon. A German company has been drilling, also without success. Exploration costs are low in Spain, and a number of other companies will begin drilling soon under the new oil law.

Switzerland—This tiny country has more activity now than at any period in the past. Three wildcat wells are drilling. SEAG (Swiss Petroleum Holding Co.) is drilling with Deutsche Elwerath as contractor British Petroleum S.A. and Ste des Interets Miniers S.A. are using a company rig. Ste. des Hydrocarbures are also actively drilling at last report.

United Kingdom—British Petroleum is the principal explorer, and an active campaign is underway. About six rigs are being used, not all of them on exploration evidently, with no discoveries reported so far in 1960.

Africa

World exploratory attention continues to center on Africa, until recently the great unknown so far as oil was concerned. While discoveries of major size have tended to be in North Africa, the remainder of the continent has contributed a number of small fields and interest in the area is high.

Algeria—A total of 43 rigs are working, 16 on wildcats. Of the exploration rigs, 12 are heavy and four are medium. The principal recent discovery was No. 103 Ohanet, second stepout from Mobil et al.'s eastern Sahara discovery, for which the French firm CEP is operator. The new well is two miles north of Ohanet No. 1 (a 1,900 b/d producer) and two miles south of No. 102 (drilling below 1,700 ft).

Angola—Cabinda Gulf Oil Co. has one rig working. Santa Fe Drilling Co. is the operator. No discovery has been reported. Petrofina has four company rigs working, and unconfirmed reports of another discovery have been received.

Egypt—Although no new finds have been reported, exploration is proceeding at a rapid pace with 12 rigs running. Efforts are concentrated on the Red Sea area where several offshore tests are underway.

Gabon—Four rigs are running, two of them under contract to SPAFE by Forex, and two company rigs. An exploratory well is drilling on the Gongoue structure and on the Rembo Kotto structure. Another is scheduled for the Zénézarongue area.

Libya—Oil exploration is booming, with 33 rigs active and exploratory tests being drilled at a fast rate. Principal recent find was Mobil's third completion on its concession 11 in eastern Libya (about 360 miles southeast of Tripoli) which has extended the Hofra field about 3½ miles. Hofra A3-11 flowed 890 b/d of 43.9-gravity crude through a ½-in. choke at 3,100 ft. Tests showed 1,300 cubic feet of gas per barrel.

Rated crude production in Libya currently is 69,185 b/d and 16.5 mmcf/d of gas. As of mid-June, 32 productive oil wells and three gas wells had been found.

A tract of four concessions totalling 10,500 square miles offshore the Gulf of Sirte has been obtained by Atlantic Refining Co. Exploration blocks No. 86 through 89 range in size from 1,822 to 3,409 square miles.

Middle Congo—SPAFE is drilling with one rig. No discovery has been reported.

Morocco—The principal explorer is ENI, the Italian government's company. A discovery at Oum Doul, only about 35 miles north of the Spanish Sahara, has been reported but not confirmed.

Nigeria—Six rigs are working, four company rigs belonging to Shell-BP and two contractor rigs for the same company. There are eight more company rigs on completions. No recent discoveries are reported.

Senegal—SPS (Ste. des Petroles de Senegal) has four rigs working, two on development. Forex is contractor for one more rig now on exploratory work.

Somalia—Sinclair Somal Corp. is continuing its exploration with one rig. International Drilling Co. is the contractor. No discoveries have been reported.

Somaliland Protectorate — British Petroleum is drilling with one company rig. No oil finds have been reported.

WORLD CRUDE PRODUCTION—FIRST HALF 1960
(Barrels Daily)

	First Half 1960	First Half 1959
North America		
Canada	548,200	499,800
United States	7,042,000	7,154,800
Mexico	264,000	265,200
Total	7,854,200	7,919,800
South America		
Argentina	142,100	117,800
Bolivia	8,200	8,600
Brazil	76,500	56,800
Chile	18,800	16,700
Colombia	156,600	141,400
Cuba	400	500
Ecuador	7,900	7,800
Peru	52,100	48,000
Trinidad	118,400	109,100
Venezuela	2,840,000	2,837,200
Total	3,421,000	3,343,900
WESTERN HEMISPHERE	11,275,200	11,263,700
Europe		
Austria	45,600	46,600
France	36,700	29,300
Germany (West)	103,900	99,000
Italy	31,000	28,200
Netherlands	33,100	33,600
United Kingdom	1,700	1,600
Yugoslavia	13,100	11,100
Total	265,100	249,400
Africa		
Algeria (OCRS)	23,400	14,300
Angola	1,200	950
Egypt	58,900	59,600
Gabon	14,400	13,700
Morocco	2,100	1,800
Nigeria	17,000	7,400
Total	117,000	97,750
Middle East		
Bahrain	45,000	45,050
Iran	1,001,000	903,700
Iraq	925,000	801,600
Israel	2,000	1,900
Kuwait	1,581,000	1,391,700
Neutral Zone	128,000	111,500
Qatar	170,000	169,900
Saudi Arabia	1,215,200	1,067,800
Turkey	6,900	6,800
Total	5,074,100	4,499,950
Asia & Australasia		
British Borneo	110,100	111,300
Burma	10,500	10,300
India	8,300	8,300
Indonesia	399,100	330,100
Japan	9,100	8,500
New Guinea	4,100	4,700
Pakistan	5,900	6,000
Total	547,100	479,200
EASTERN HEMISPHERE	6,003,300	5,326,300
WORLD	17,278,500	16,590,000

Middle East

The exploratory pace in the Middle East has not slowed down, but with the threat of a crude price decline looming, it may. Some companies may find it cheaper to buy crude than to look for it soon. Some, such as Texaco in certain instances, are already on that bent. Meanwhile, however, exploratory plays already underway continue to forge ahead.

Abu Dhabi—Abu Dhabi Marine Areas Ltd., owned two-thirds by BP and one-third by Cie. Francaise des Petroles, has continued stepping out from the original discovery well at Umm Shaif. One rig is being used.

Bahrain—One rig is drilling an offshore test for Bahrain Petroleum Co., a Caltex affiliate. The well is not yet deep.

Israel—Exploration has slowed, at last report only two rigs were working on development, extending recent gas finds. No wildcats are reported.

Iran—Fourteen rigs are working, some of them on important wildcat wells. IPAC, affiliate of Pan American International and the government's NIOC, is drilling its second offshore well. The first had some shows but twisted off below 13,000 ft. Also offshore, the Italian government's AGIP, also with NIOC, is testing its first wildcat which reportedly had some oil shows.

NIOC is using four drilling rigs on exploratory work, two at Gorgan and one at Alborz, with one rig stacked. Two others are operated by Seacat Drilling Co. at Sarajeh on development work.

The Consortium has eight drilling rigs in use, an increase of one over last year. Four are being operated by Santa Fe Drilling Co., three by International Drilling Co. and one by Seacat. Only the driller is an expatriate in six cases while one of the Santa Fe and one International Drilling rig have entirely Iranian crews.

Iraq—Exploration is going forward steadily in Iraq, but without spectacular results—at least so far. Iraq Petroleum Co. is using three rigs in its concession area, two of them being operated by Drilexco and one by the company. Basrah Petroleum Co. is using three rigs also, one a company rig and two operated by a contractor, Kier Cawder-Arrow. Mosul Petroleum Co. has only two rigs operating, both company.

Jordan — Phillips Petroleum Co. has drilled another dry hole using Parker Drilling Co. as contractor. The area is the old Pauley concession, and Phillips is considering surrender of the concession back to the Pauley interests.

Kuwait—At last report, three rigs were running, all owned by the company. Minagish No. 1 exploratory well has been completed to produce from the Ratawi limestone, but full assessment of its potentialities awaits production facilities. Minagish No. 2 is drilling at a location about one mile southwest of No. 1, to help define the structure and extent of the reservoir rocks. Dibdibba No. 1 was discontinued after the well had reached the Mauddud limestone. Operations on Mutriba No. 1, were discontinued in November. A new well is to be drilled to explore deeper horizons on this structure.

Lebanon—An exploratory concession is reported to have been granted to an American investor. No drilling is in progress. The third test ever to be drilled in Lebanon will be underway shortly by Gewerkschaft Elwerath which acquired half interest in Cie. Libanaise des Petroles. Two 6,500-ft tests are to be drilled before year-end 1961.

Muscat & Oman—In the areas of Muscat & Oman east of Dhofar province, an IPC affiliate has been drilling with one heavy rig. No operations are believed to be in progress at present. The American partners dropped out of this phase of IPC's operations, as the companies composing IPC are able to do, leaving only the British, Dutch and French interests to carry on.

In Dhofar province, a Cities Service affiliate has been drilling with two rigs, keeping one heavy rig stacked. No discovery of commercial importance has been announced.

Neutral Zone — The only exploratory work being done at present is offshore. There, Arabian Oil Co., with Japanese interests and the governments of the Saudi Arab and Kuwaiti nations represented, has continued development of its recent discovery. International Drilling Co. and Seacat Drilling Co. are operating rigs.

Saudi Arabia—Three rigs are active, two onshore and one offshore. No exploratory discoveries are reported. With six producers and one observation well shut in at its Manifa field, Aramco has also decided to concentrate on further "delineation drilling" at Safaniya.

Qatar—Shell Co. of Qatar has discovered oil in its third Persian Gulf well, Idd el Shargi No. 2, 50 miles offshore and northeast of Doha. Shell has spent more than 7½ million pounds sterling off Qatar. Testing continues, and further wells will be drilled on the structure.

Syria — Concordia, affiliate of Deutsche Erdoel, is drilling with three rigs, with no exploratory finds reported since the strike in the north. Negotiations are now going on for an exploitation concession covering the find.

Turkey—There are 12 rigs in operation, of which at least half are on exploratory wells. Mobil International Oil Co. (division of Socony Mobil Oil) announced in July its affiliate in Turkey had discovered oil in a wildcat well 40 miles inland from the port city of Mersin on the Mediterranean coast. Mersin is the site of a 65,000 b/d refinery currently under construction. Discovery well Bulgardag No. 1 indicated on drill-stem tests a potential of 240 b/d of 36-gravity crude before acidizing and fracturing. The oil-producing stratum was encountered at about 4,700 ft. Bulgardag No. 1 is Mobil's first discovery after three dry holes and an extensive seismic program dating back to 1955. The well is being drilled deeper.

Kuleli No. 1, drilled jointly by the German firm Deilmann Petrol Ltd. and NV Turkse Shell 22 miles east of Edirne in northern Thrace, may prove to be European Turkey's first oil discovery. Though the well had an intermittent flow of gas, oil, and water in Tertiary at 2,700 meters (about 8,850 ft.), its commercial potential has not as yet been determined.

Central America

Little exploratory activity is underway, except for the countries listed below.

British Honduras—Phillips Petroleum Co. is continuing its efforts in British Honduras, drilling with a National 55 rig, capable of reaching 10,000 ft. No discoveries are reported.

British Guiana — No drilling has been done by the Standard Oil Co. of California affiliate which holds the principal petroleum right in this area.

Costa Rica—Union Oil, in 50-50 partnership with Gulf Oil Corp., is continuing its exploratory campaign and is drilling with one rig. No discoveries have been made since the first well which had good shows, later encroached by salt water.

Cuba—All exploratory drilling has ceased and no rotaries are active in the wake of the Castro economic policy. The government's Petroleum Institute announced it will drill a 12,000-ft test soon, and repeated its belief that the oil companies formerly drilling in Cuba had made discoveries which were secretly shut in.

Guatemala—Ohio Oil Co., drilling for a group of USA oil companies, completed its second dry well recently and is now scouting for a third location. Guatemalan Atlantic, another group effort, also has drilled recently without result.

Mexico—Exploration is proceeding with 140 rigs in active use, 96 belonging to Pemex, the remainder to contractors. Pemex, the government's oil monopoly, has refinanced its operation with the help of foreign loans and is starting an intense campaign for new reserves. The Jurassic is the latest play, and wells are starting to crowd into the Eastern Sierras. Natural gas is supplying much of Mexico's demand now and exploration for gas has accelerated.

Panama—No wildcat wells are drilling now, and the government is working on a new oil law designed to stimulate exploration.

Trinidad — Exploratory wells are being drilled by Zapata Offshore Co. in the Gulf of Paria for Kern Trinidad Oil Fields. Dominion Oil Co. is continuing investigation of its offshore discovery.

South America

Argentina—Exploration is actively going on, with at least one significant find reported recently by the Carl M. Loeb, Rhoades Co., which is operating under contract to the government's Yacimientos Petroliferos Fiscales (YPF). A five-mile stepout in Mendoza appears to have considerably enlarged reserves available in that area. The same company is also drilling its first exploratory well in the Comodoro Rivadavia area.

Pan American also is operating for YPF under a contract and has boosted its production considerably. Little exploration is being done at present, however. Union Oil is exploring in Comodoro Rivadavia, without discovery results to date. Shell has not yet begun exploratory drilling and Esso has had a series of dry holes in its new area so far.

YPF has announced that drilling of wells in the south flank of Comodoro Rivadavia proceeded ahead of schedule during the first four months of 1960. Total wells during the period numbered 166 against scheduled drilling of 162. YPF itself drilled 100, and had planned 98. Private companies drilled 66, against 64 planned.

Chile—The government has a monopoly over oil exploration throughout the country and at present has five rigs working, most of them on contract from Santa Fe Drilling Co. No discoveries have been reported.

Colombia — The most encouraging discovery lately was by Texas Petroleum Co. when its Guavio 1 well, 100 miles east of Bogota, tested 278 b/d. The company is trying to decide whether to drill more wells in the Llanos section, since a pipeline across the mountains to link with lines on the Magdalena River would cost about $20 million.

Peru—Some exploration is going on offshore, and Cerro del Pasco Corp. is preparing to drill a wildcat far in the interior jungle areas. Equipment is now being moved in. No other rank wildcats are drilling.

Brazil—Despite a long exploratory campaign, Petrobras has not made any exploratory finds as yet. About 62 rigs are running, with many of them in the rough and inaccessible Amazon region. Footage drilled from January to April totalled 349,463, most of the total being production wells. Petrobras is about to begin drilling at Aracatuba in Sao Paulo state. Petrobras has denied operations in the Amazon region are to be abandoned, but admits operations there are expensive. They cost two billion cruzeiros in 1959 and will cost 2.5 billion in 1960. Average monthly cost of a geological surface party is 423,000 cruzeiros and 4,300,000 cruzeiros for geophysical.

Bolivia—No discoveries have been made in Bolivia as yet, but belief persists in many companies that major finds will eventually turn up. The government agency for oil, YPFB, has 11 rigs running, plus one contractor, Chief Bolivian Drilling Co., using one rig. The same contractor is working for Bolivian Oil Co. with two rigs. Bolivian Oil Co. is the Gulf subsidiary. Chaco petroleum, S.A., operating for a group of American independents, has one contractor rig running and two company rigs stacked. No discoveries have been reported yet.

Shell and California Standard plan their first wildcat soon. The test will be in Zone 1 of the province of Santa Cruz, in the south-central part of Bolivia.

Venezuela — The government has announced selection of eight new tracts in Venezuela, for its new national oil company. They include one in Guarico state, and seven in Anzoategui—five in the Oficina area and two in the Anaco-San Joaquin area. These are in addition to the Maracaibo Lake acreage already selected by the company. All adjoin producing acreage held by private companies.

Private operations in Venezuela are down to record low levels. There are no seismic parties now in operation, as of the first of August there were only 39 rigs operating. The rigs included three for Texas Petroleum Co., one for Mobil Oil, two for Venezuelan Sun, three for Phillips, two for Paria Operations Inc., 14 for Mene Grande Oil Co., six for Creole, five for Shell, one for Sinclair and two for Richmond Petroleum.

END

ROTARY DRILLING RIGS ACTIVE
(OUTSIDE SOVIET BLOC)
(As of July 1, 1960)

South America & Caribbean	
Argentina	121
Bolivia	15
Brazil	55
British Honduras	1
Chile	5
Colombia	25
Costa Rica	1
Cuba	0
Dominican Republic	1
Ecuador	3
Guatemala	2
Mexico	140
Peru	13
Puerto Rico	1
Trinidad	31
Venezuela	39
Total	453
Middle East	
Abu Dhabi	1
Bahrain	1
Iran	16
Iraq	8
Israel	2
Jordan	1
Kuwait	4
Muscat & Oman	2
Neutral Zone	4
Qatar	1
Saudi Arabia	3
Syria	3
Trucial Coast	1
Turkey	14
Total	61
Africa	
Algeria (OCRS)	43
Angola	5
Egypt	12
Gabon	4
Kenya (strat test)	1
Libya	33
Madagascar	2
Congo	1
Morocco	5
Nigeria	6
Senegal	4
Somalia	1
Somaliland Protectorate	1
Tunisia	2
Total	120
Asia & Australasia	
Australia	9
British Borneo	6
India	13
Indonesia	7
Japan	15
New Guinea	1
New Zealand	1
Pakistan	9
Papua	1
Philippines	3
Taiwan (Formosa)	7
Timor	1
Total	73
Europe	
Austria	23
France	36
West Germany	105
Italy (incl. Sicily)	60
Netherlands	6
Spain	7
Switzerland	3
United Kingdom	6
Total	246
North America	
Alaska	5
Canada	145
United States	2,140
Total	2,290
TOTAL WORLD	3,243

RUSSIAN OIL COMPETITION

Oil from Russia has invaded world markets and further undermined crude prices. Growing oil use within Russia seems destined to block exports on a major scale, however.

INTRUSION OF RUSSIA into Cuba with crude oil a dollar per barrel below world prices and into India and Ceylon with crude and product prices well below those offered by commercial oil companies has centered attention on the growth pattern of Soviet exports. International oil executives who were on the job as young men 30 to 40 years ago well remember the competition of Russian oil in the early days of the Soviet Union when the young communist nation was in special need of foreign exchange. The situation is much different at the present time, however:

1. Communist oil exports have been growing steadily in recent years and at a faster rate than the growth in world demand.

2. Some communist export deals in recent months have been motivated more by political considerations than by desire to expand foreign trade. Cuba would not be sought as a market by an exporter from Black Sea ports in the normal course of trade when the rich markets of Western Europe are next door. The same is true of the long haul through Suez to India.

Since the close of World War II Russia has attempted to rejuvenate its old fields in the Caspian area and more importantly has built large new reserves to the East. Domestic demand has been shifted as rapidly as possible from coal to oil. Chief retarding factor has been steel for pipelines and field development.

The USSR now seems to have a more adequate supply of steel as may be seen from the major pipeline projects which are under way. One important phase of this new pipeline system is the fact that gas is being brought to market in important quantities and is replacing oil as an energy source in much the same way that gas is supplanting oil in the USA and Canada.

To many observers it seems inevitable that Russia will be a competitor for world energy markets in coming years both in the political area and in the true commercial sense. The extending lines reaching westward from the Urals to the plains of Poland and Germany are casting their shadows ahead.

Russia has increased exports in international markets from 40,000 b/d in 1953 to 350,000 (or possibly 400,000) b/d in 1960, about ten-fold. There can be no doubt the Soviets are now a major factor in world markets.

It may be argued that even the 400,000 b/d level is only 2% of world oil use. However certain markets are closed to Russian oil, and as a result Soviet exports are confined to markets where they loom considerably larger. Presuming that such markets as the United States, United Kingdom, Australia, Canada and others are closed to the Soviets, the percentage of world oil use represented by Russian oil outside these markets rises to 7%. In some markets Soviet oil supplies much more; 90% in the case of Finland. Some products are much more important too, as in Sweden where the Soviets have 30% to 35% of the important fuel oil sales.

Exports from the Soviet Bloc during the past few years have been as follows (in barrels daily):

1953	40,000	1957	140,000
1954	100,000	1958	220,000
1955	100,000	1959	290,000
1956	120,000	1960	350,000 to 400,000

How high will they go in the future? That is anyone's guess, but it is not likely that Soviet exports can reach truly large proportions. To do so would deprive the Soviet economy, which is increasing its fuel use rapidly, of valuable energy supply, especially since the use of oil and gas as a percentage of total energy use is rising sharply. Presuming that the current Russian projection of 7-8,000,000 b/d production by 1975 is correct, and it seems feasible, then Russian oil exports could reach about 600,000 b/d by that time. The Russian satellites may be ignored for they do not aid in exports nor are they expected to do so in the future. On the contrary, they also import from Russia, and in 1975 are estimated to continue doing so at the rate of about 800,000 b/d.

While these figures are large, world demand is growing too. The Russians seem fated to continue in the role of a relatively small exporter, although their peculiar faculty for maximizing the impact of each barrel in terms of political advantage may increase. Nevertheless, Russians show no inclination to wreck the international market. They would gain the undying emnity of producing nations if they did, and gain little or nothing by it. They will use it as they have in Cuba, where the companies refusal to refine Russian crude brought the "intervention" of American refineries (which would probably have been taken over anyway) and in India, and these efforts should not be taken lightly. Concerted action on the part of oil's management should be able to meet that threat, however.

SOVIET PRICING POLICY

The USSR has tended to sell its crude at just enough discount to enter the market, averaging 10 to 20%, and where it has not had to give a discount because of trade agreements and advantages it did not give any. In Sweden the much-discussed Russian invasion of the important fuel market was made at a price for fuel oil of Platts low in the Caribbean minus 25%, plus freight from the Black Sea. It worked out to about $1.87 per barrel, compared with about $2.40 for Western crude, using the Aruba posted price of $2.00 plus 40 cents for tanker freight.

In Brazil the Russian crude price was about $1.75 per barrel f.o.b. Black Sea, not much of a discount but it involved taking coffee and cacao. In France prices on crude and products were Platts low in the Persian Gulf minus 5 to 7% f.o.b. Black Sea. The rates from the Caribbean are about equivalent to Black Sea rates. In Germany the USSR crude price was $2.24 c.i.f. This compares with Middle East prices of $1.90 (before the price cuts) plus 40 cents tanker rates or about $2.40 to $2.30. In Italy fuel oil was quoted by the Reds at $1.70 to $1.75 per barrel. It looks cheap, but this area has long been a competitive one for fuel oil due to the large number of refineries in Italy and the price would probably have reached that low in the area anyhow.

The deal in Japan was the one that gives bad dreams to Western oil exporters. The Russians accepted a realization of $1.00 per barrel f.o.b. Black Sea. Adding the tanker cost of about 40 cents this is a discount of about 20%.

The Soviets offered a 20% discount to the Indian government on products and about

20% off Western prices on landed Western crude prices. The discount was not great enough to cause the government to fight with the companies when they refused to accept the crude, however, and the companies have met the discounts now with their own, unfortunately after the Soviet offer.

Finland is a special case. Crude prices quoted by the Soviets are not known, but products are going for the low of Platts less 8 to 15%. The price is less important than the trade agreement, which makes Finland virtually an economic satellite of Russia.

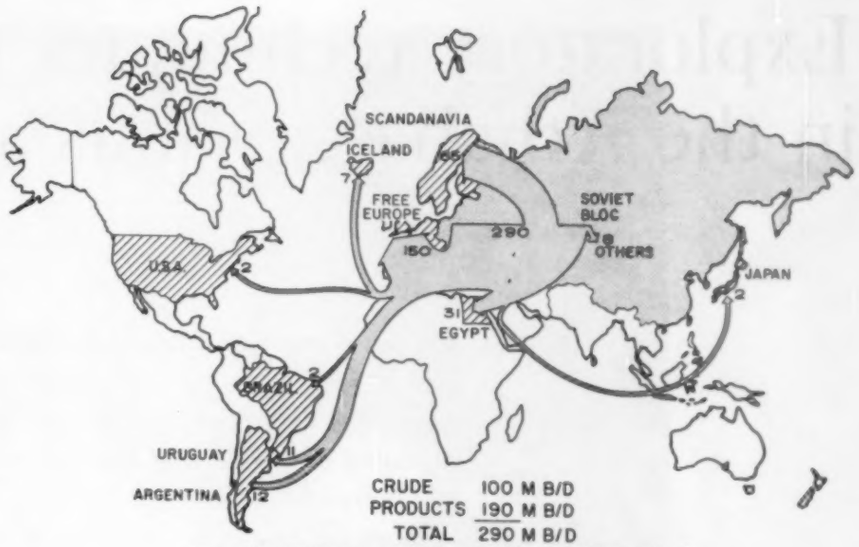
Standard Oil Vs. Russia: Following the seizure of its refinery in Cuba, Standard Oil Co. (New Jersey) has attempted to block private tanker owners from chartering to the Russians. The company put out a statement clearly pointing out that those who did so would not be looked upon with favor by Jersey, the world's largest charterer of oil tankers, when the current oil surplus is over. Merely saying that tanker owners who carried Russian oil to Cuba would not be enough, for any charter to the Russians would release Russian ships that would then go to Cuba. It had to be all or nothing at all, and the Cuban situation seemed like a good place to draw the line. Standard Oil Co. of California went along almost immediately, and so did Golden Eagle, affiliate of the fourth largest British company, Ultramar. No one else had, as of the end of July, much to Jersey's disappointment. So far there has been no indication Shell will join the embargo, unless an increase in insurance rates recently could indicate the move is coming.

RUSSIAN OIL TRADE AGREEMENTS

Soviet oil agreements are about 80% for black oils, running 80% fuel oil and gas or diesel oils. They are usually one to three years in duration, and when longer carry firm contracts for oil supplies only for one or two years. Russian oil goes either at world competitive prices through the government's barter arrangements, where it is traded for goods, or at cut prices in competitive markets through brokers. Some Soviet oil even comes into the United States, and a small quantity (about 1,500 b/d) of benzine has been coming into the Gulf Coast area of the US for years under a contract arrangement with one of the major oil companies.

South America: Argentina seems out of the Soviet sphere of oil trade now, inasmuch as the government's YPF has had signal success in increasing the country's domestic production, but Brazil is still importing an estimated 14,000 b/d, mostly crude, in 1960 under a three-year arrangement which exchanges coffee and cocao.

The only other importing country in South America, outside of Cuba, is Uruguay where an off-again, on-again basis seems to reign for small amounts of crude. In Cuba, where the Russian oil exports have succeeded in a spectacular way, Russia is determinedly pushing its tanker deliveries to meet Cuba's 60,000 b/d requirements. Russian oil is by far the most important item to be supplied by Russia but is not one of the categories of goods to be specified under a 12-year line of credits in exchange for one million tons years of Cuban sugar.



Soviet Bloc Oil Exports to the Free World—1959 (Thousands of Barrels Daily). Source: "Review of Foreign Oil Production in 1959," by H. W. McCobb, Vice President, Standard Vacuum Oil Co.

Eastern Hemisphere—Elsewhere in the world, Russia is determinedly pushing its trade agreements and has succeeded despite considerably higher transportation costs. In Austria, the recent accord signed with the government makes that country recipient of Russian crude in the next few years. It is not a typical trade agreement, however, but a reparation adjustment under the 1955 treaty of Vienna.

In Denmark, Soviet oil, mostly products, is scheduled to flow at the rate of 5,000 b/d. The agreement is for two years, but the Soviets have not been able to place all the crude, however.

Egypt continues her agreement with the USSR but quantities grow steadily smaller as local production grows. The agreement is renewed annually and probably will eventually disappear. There are actually two agreements, one with Romania for fuel oil and one for crude and some products from the USSR.

Finland gets 90% of its oil from the Soviets. The amounts for 1959 included 17,400 b/d of crude, plus that much in products. The products were mostly fuel oil and diesel fuel, but some kerosene, gasoline, lubes, and asphalt were included.

France is receiving considerable amounts of Russian oil. The exact amounts during 1960 are difficult to determine since much oil delivered to Italy by the Soviets is refined and then shipped to France where it enters as Italian oil. In 1959, however, 16,000 b/d of crude and 12,510 b/d of products were sent in. An agreement with the USSR for the three-year period of 1960-1962 calls for delivery of 14,000 b/d of crude in 1960 plus 12,000 b/d of products, with 11,000 b/d of crude to be delivered in 1961 plus 11,000 b/d of products. There is also an agreement with Romania for delivery of some products during 1960.

Western Germany is coming in for its share of imports, with 20,000 b/d of products scheduled for 1960, plus 9,400 b/d of products, mostly fuel oil.

Greece has a three-year agreement covering the January 1958 to Dec. 1960 period delivered in 1960. Guinea also has an under which 10,000 b/d of crude will be agreement to receive an unknown amount of petroleum products.

Iceland is renewing annually an agreement for delivery of around 6,000 b/d of products.

A large consumer of USSR crude is Italy. Russian agreements have recently been revised upward to provide for 60,000 b/d of oil, mostly crude, to be delivered in 1960. It will amount to about 15.2% of demand.

Japan is another large user of USSR crude. Idemitsu Kosan, Japan's biggest independent, recently signing a contract for delivery of 20,000 to 30,000 b/d of Russian crude for six years. The f.o.b. price is considered by the government of Japan as officially 97 cents per barrel, almost 50% under Middle Eastern quotations. Under Japan's import rules, this will enable Idemitsu to import 60% more crude for the same amount for foreign exchange. Another independent in Japan, Toa Oil Co., began importing about 15,000 tons of oil in August. Shin Asia, another Japanese company, has a contract and is negotiating for another 4,000 tons, according to reports.

In Morocco an agreement covered 1958 imports but no later agreement is reported. In Norway, contract covering the three year period of 1959-1961 calls for mostly fuel and diesel oil (200,000 tons) and paraffin wax (500 tons) over its duration. Others, believed to have lapsed, were with

(Continued on page 134)

Exploratory techniques today in the Athabasca sands area

by William B. Gallup*

300 miles north of Edmonton are the Alberta oil sands, the world's largest known reserves of hydrocarbons—over 40 billion bbl of recoverable oil at or near the surface and over 270 billion bbl of estimated total reserves. This review of exploration techniques is followed by recent pictures of the research project to find methods of recovering useable oil from these Athabasca sands

THE ATHABASCA BITUMINOUS SANDS have been subject to sporadic investigations since the beginning of the century. It is probable, however, that much of what has been learned and achieved concerning the deposit has been accomplished in the last few years.

Early explorers and fur traders such as MacKenzie and others noted the "pitch" saturated sands along the Athabasca River in the vicinity of the junction of the Clearwater with that river. R. G. McConnell in his surveys of the Athabasca River for the Geological Survey of Canada in 1892 and 1893 identified the sequence, and described it, as the McMurray formation.

Attempts to recover the oil which outcrop indicated must underlie the surface began with the drilling of a hole by Von Hammerstein in 1900 when he tried to tap a pool in the underlying Waterways formation which he felt must be the source of the "assinpiskew," or rock gum as the Cree indians called it.

This concept of the source of the bitumen prevails to this day, and although the hydrocarbons were probably formed in Devonian sediments, they have apparently long since evacuated strata of that age.

Since Von Hammerstein's pioneer efforts, there has been a continuous procession of scientists, drillers and various "crackpots" to and from the Fort McMurray area seeking the key to economic recovery of this most vast petroleum deposit. Sadly enough, almost 60 years later not one profitable barrel of oil has yet been recovered, although some separation has been achieved by hot water flotation methods using bituminous sand taken from open pits.

The earliest comprehensive analysis of the deposit was done during the early 1920's. S. C. Ellis mapped the distribution of the bituminous beds in outcrop, did extensive samplings, and offered an analysis of the extraction problem with respect to mining and separation.

The first comprehensive and well planned drilling program was undertaken by Canada's Dept. of Mines during World War II, under the direction of Dr. George Hume. Contingent upon this drilling was the experimental hot water plant at Fort McMurray. Sporadic drilling has continued throughout the years by various oil companies.

However, the greatest period of activity began in January, 1956, with the announcement by the Royalite Oil Co. of their intention to apply the Coulson Centrifuge method of extraction to mineable deposits of bituminous sand at Bitumont and Mildred Lake. As a result of this renewed activity, the entire Athabasca bituminous sand area of about 4,000 sq miles is now held under 77 individual permits which involve over 50 oil companies.

To date, there have been nearly 1,000 holes drilled to explore the richness and extent of the deposits, and probably 30 to 40% of these were undertaken in the last three years. Of particular importance during the last few years is the increase of exploration back from the river, thus removing considerable conjecture concerning the extent and real nature of the tar sands which are, in fact, a bituminous facies of the McMurray formation.

Exploratory Operations

Exploratory problems are many and complex. Fig. 1 is a topographic map of the area underlain by the so-called tar sands. It is covered by a forest growth varying from sparse to dense. Muskeg is prevalent, and locally the relief is considerable as in the Birch Mountains which rise to an altitude of 2,700 ft, 2,000 ft above the Athabasca River 20 miles away.

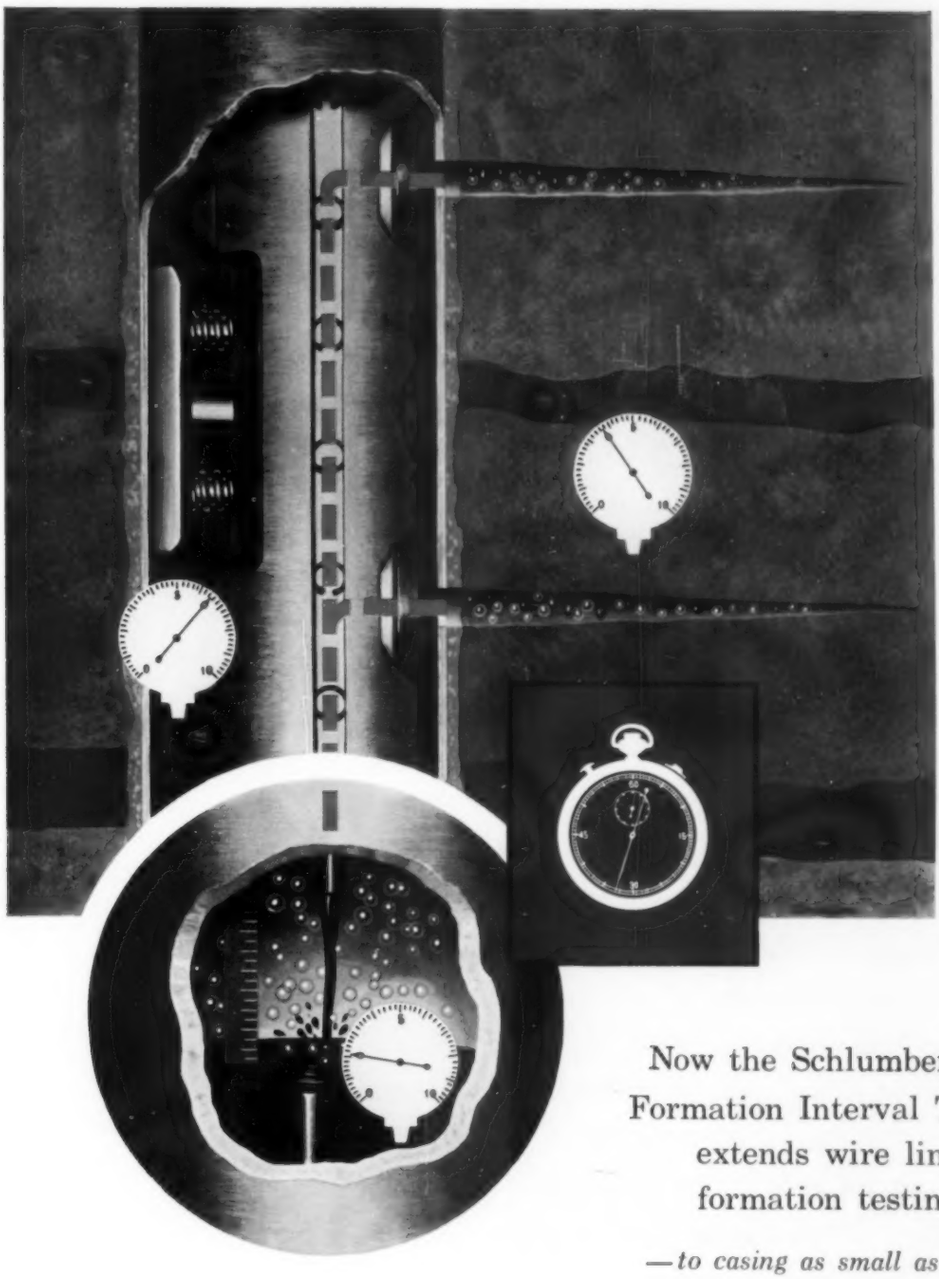
Access during the summer is by boat down river from Fort McMurray, and in the winter by a road cleared on the river ice. Hence, back from the river a network of bulldozed roads developed, mainly during the past three years, although several trunk roads had been in existence much longer. These roads—totalling in excess of 2,000 miles—have all, with three exceptions, been cleared by oil companies holding land in the area.

Two important and well developed roads have been constructed by the Forestry Service to areas south and southwest of Fort McMurray, and the Horse River trail has long been cleared and in use by telegraph, and lately, by telephone companies.

The bituminous sands of the McMurray formation accumulated in sand bars, spits and shoals in a fresh and brackish water lagunal environment. It is probable that much of the sand was derived from the region of the Athabasca sandstone immediately to the northeast. In view of the nature of deposition, it is evident that the sand must be most erratic in occurrence, development, and distribution, a circumstance which renders an estimation of reserves or evaluation of acreage not substantiated by drilling a very vague and unsatisfactory procedure, at least in detail. However, sufficient control is now established so that areas can be fairly accurately designated as rich, lean or barren, even though attractive bituminous lenticles can and do occur locally in areas generally lean or barren. Thus, all acreage within the general limits of the deposit must be evaluated by at least a reconnaissance drilling program. The relationship of richer beds to certain lithologies is now recognized so that some evaluation of the possibilities of further drilling is possible from the lithology even where bitumen is absent or lean.

Fig. 2 is an illustration prepared from an isopach map of sands having a bitumen content above 10 wt-%. The control for this map is developed from core and electrolog analysis of about 500 holes. We believe the oil to be sedimentary in origin and

*Mr. Gallup is associated with the firm of Gallup, Buckland and Farney Ltd., Calgary, Alberta.



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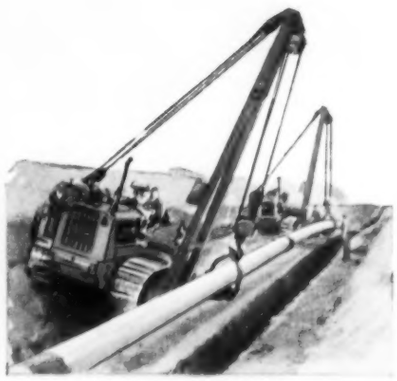

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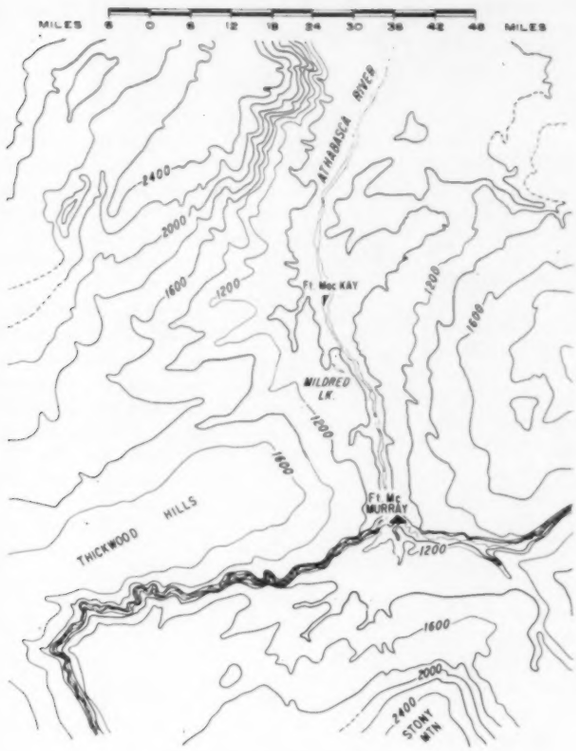


Fig. 1—Topographic map of the Athabasca bituminous sands area

Fig. 2—Bituminous sand distribution in Athabasca area, from an isopack map

that this map is therefore, in effect, a chart showing sand bars, spits and shoals on which oil floating on the surface of the lagoons stranded and accumulated.

In Fig. 3 a south-north cross section shows again the erratic development of the deposits and the impossibility of satisfactory correlation throughout the section. It should be emphasized that since it is here considered that the bitumen is contemporaneous with the sand, our only concern is with the bitumen deposits or bituminous facies of the McMurray formation as far as this map and cross section are concerned.

There do occur in the area, particularly toward the perimeters and the base of the section, non-bituminous sands which are not taken into consideration on the sand map nor accentuated in this illustration, for example, the basal water-saturated sand.

The foregoing is intended to illustrate the exploration problem which is now being attacked by the various permit holders in a remarkably uniform and co-operative manner. The map in Fig. 1 embraces the area now under exploration. The field season is, generally speaking, January through March, although certain localities can be worked in the summer, especially if it is dry.

Summer access downriver is by barge on the Athabasca River to a point where equipment may be moved overland to drilling sites. In dry summers, access south and west of McMurray is possible on roads developed by organizations outside the oil industry. In late December, a road is cleared on the ice from Fort McMurray to Bitumont as a co-operative effort on the part of several companies. This road provides rapid and convenient access to permits along the river, and it is usable until late April.

There is also a road along the left bank of the river to Tar River Dock, opposite Bitumont, which provides year-round access to areas west of the river. It is used mainly in the winter for movement of heavier equipment and is reached in that season by

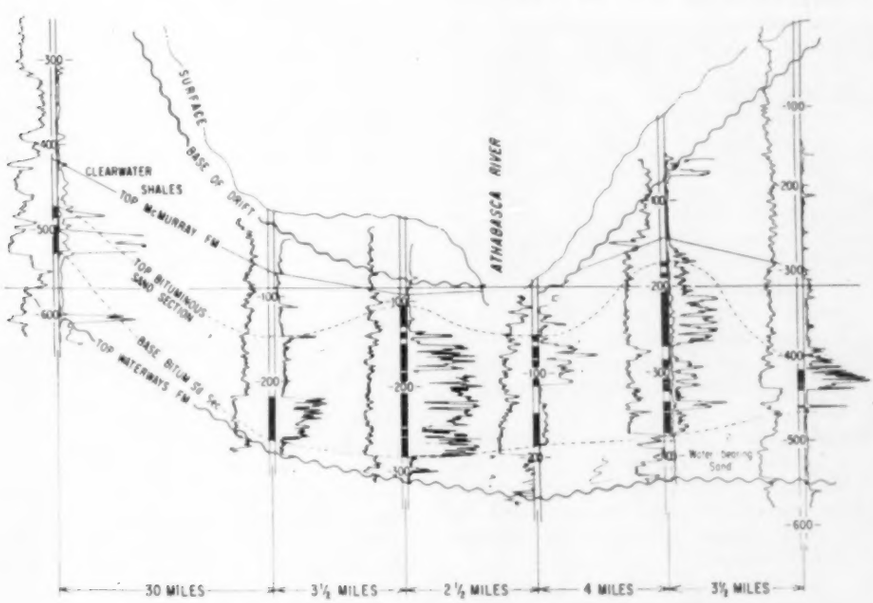


Fig. 3—East-west cross-section of the bituminous sand across almost the entire breadth of the area. Note erratic development of sand and occurrence of water at base to east

an ice bridge, also a cooperative project, off the west end of Fort McMurray's main street. In summer, equipment is moved to it across the Athabasca by barge.

The winter season is one of impressive activity. From January 1 through March of 1959 there were 13 drills (counting one at Chard), supported by about 25 bulldozers, all being manned by a total personnel of drilling crews, catskinners, cooks, geologists, surveyors, etc. from 250 to 300 men.

An operating unit generally consists of one drill of the Failing 1500 type, two bulldozers (usually Caterpillar D-7's), a logging unit (Schlumberger laterolog and radioactive logs are most widely used), a geologist and a survey crew. These people are housed in trailer camps, which are moved every three to five days. Tractor and drill crews usually have separate camps as the tractors should keep ahead of the drills. Surveyors live in the tractor camp while geologists and logging crews stay with the drill camp.

We have found that a two-drill unit is most efficient, as it actually cuts waiting time on the logging unit in half and keeps the tractors working at full capacity to stay ahead. Both of these services are very expensive and their improved efficiency is essential to keeping costs down. Table 1, a cost analysis breakdown, shows costs for a 10-hole program on a representative permit and indicates the importance of maintaining efficiency in certain items. It should be noted also that these costs will vary with weather, season, density of forest growth, and procedures such as coring and running of casing where exploratory holes are set up for extraction method experiments, as many operators are now doing.

A standard operation procedure is as follows. Access roads are prepared and locations surveyed ahead of the drills. Generally, the pattern is a 2- to 3-mile spacing so that camp and equipment are moving fairly constantly since generally only a very few holes can be drilled from one campsite. The quality of roads depends upon terrain (frozen muskeg is very difficult to smooth out), and on how far the tractors are ahead of the drills. Holes are carried through the McMurray formation unto the underlying Devonian Waterways formation and logged.

In a typical winter drilling operation, the drill is covered and there is a portable core shack for examination and sampling of cores. Selected holes are cored. Coring is instigated at the first occurrence of bitumen in the mudstream and generally is carried to the Waterways regardless of occurrence of interbedded shales. To attempt to core selectively would result in missing some bituminous sands because the lenticles of these sequences come and go quite abruptly and the rate of penetration is quite rapid. The bituminous section ranges up to 175 ft thick.

Cores are taken and canned for analysis of bitumen by weight and percentage of connate water. This analysis is used for calibration of Schlumberger logs which can thus be interpreted to give a qualitative analysis as accurate as that from cores; more so in fact, as logs give 100% "recovery" whereas the core recovery is from 70 to 80%. The core is caught in an 8-ft vee-shaped trough and quartered longitudinally with a hunting knife. This achieves ready access to the mud-free center of the core which is sampled representatively manually; up to 5 ft is sampled into a No. 2½ can, sealed, and labelled. However, two lithologies are not put into one can. The core is also described in detail and the residue from sampling is discarded. Sometimes, where very rich beds are encountered in relatively shallow depths, coring is very rapid. The writer and an assistant once logged and canned 165 ft in about 7 hrs.

Table 1—Exploration Cost Breakdown, Athabasca Bituminous Sands Area
(A 10-hole program on a representative permit)

Road building, 20 miles at $500/mile	$10,000
Coring, (5 × 150) = 750 ft at $12/ft	9,000
Drilling, (5 × 350) + (5 × 500) = 4,250 ft at $2.50/ft	10,625
Fuel costs, drilling bits, etc.	2,000
Logging, 10 holes at $800/hole	8,000
Analysis of canned cores	750
Surveying, charge 20 days at $100/day	2,000
Expenses, incl. telegraph, travel, shipping of equipment, equipment rental, and miscellaneous	1,700
TOTAL	$44,075

All holes, whether cored or drilled, are logged. Where Schlumberger logs are used, the calibration of the log and qualitative analysis from logs of uncored holes is carried on as follows:

Essentially, the bitumen saturation is deduced from the resistivity as shown by the laterolog. Resistivity is more a function of the oil/water ratio than the bitumen saturation alone. Therefore, from a core analysis, two graphs are prepared; one relating oil/water to resistivity and the second one relating oil/water ratio to bitumen saturation. Thus the number of ohms resistivity for certain bitumen saturations may be established locally, say within the boundaries of one township, for this relationship will vary with the percentage of connate water. Even locally, the connate water percentage analysis is actually a range of values and therefore, the resistivity and saturations of bitumen deduced therefrom must be a range. In actual practice, this range is close enough to be considered a point value, especially in considering the lenticular nature of the sand and the spacing of wells generally involved.

A saturation in excess of 10 wt-% bitumen is currently set arbitrarily as being of economic interest, and this 10% borderline is represented by one resistivity reading within a limited area, generally around 75 ohms.

Radioactive logs are used to eliminate shaly and tight sand sections. The remaining resistive McMurray sections are broken into representative average units, and the various bitumen saturations are deduced from the graphs.

It is probable that log analysis gives more conservative net figures than core analysis. In massive rich sections they agree closely, but where leaner thin interbeds occur, the laterolog selects such, whereas core analysis of sections in cans may not.

Reserve Estimates

From a detailed isopach map showing thickness of sands having bitumen content in excess of 10 wt-%, we have calculated a reserve of 271 billion bbl. It should be noted that this calculation does not include the leaner beds, those having less than 10 wt-% bitumen, and should therefore be considered an absolute minimum.

The techniques here outlined provide a most satisfactory method of evaluating any bituminous sand property. As drilling density increases, more and more log calibration from cores is available, and so coring may continually be reduced, providing the operator has sufficient faith in the logs. Further, the tremendous amount of roads now developed give ready primary access to almost any part of the area. Reduced costs with respect to coring and tractor work are thus possible, though this is offset by the expansion of exploration westward into areas where 800 to 1800 ft holes are required.

Recovery Methods

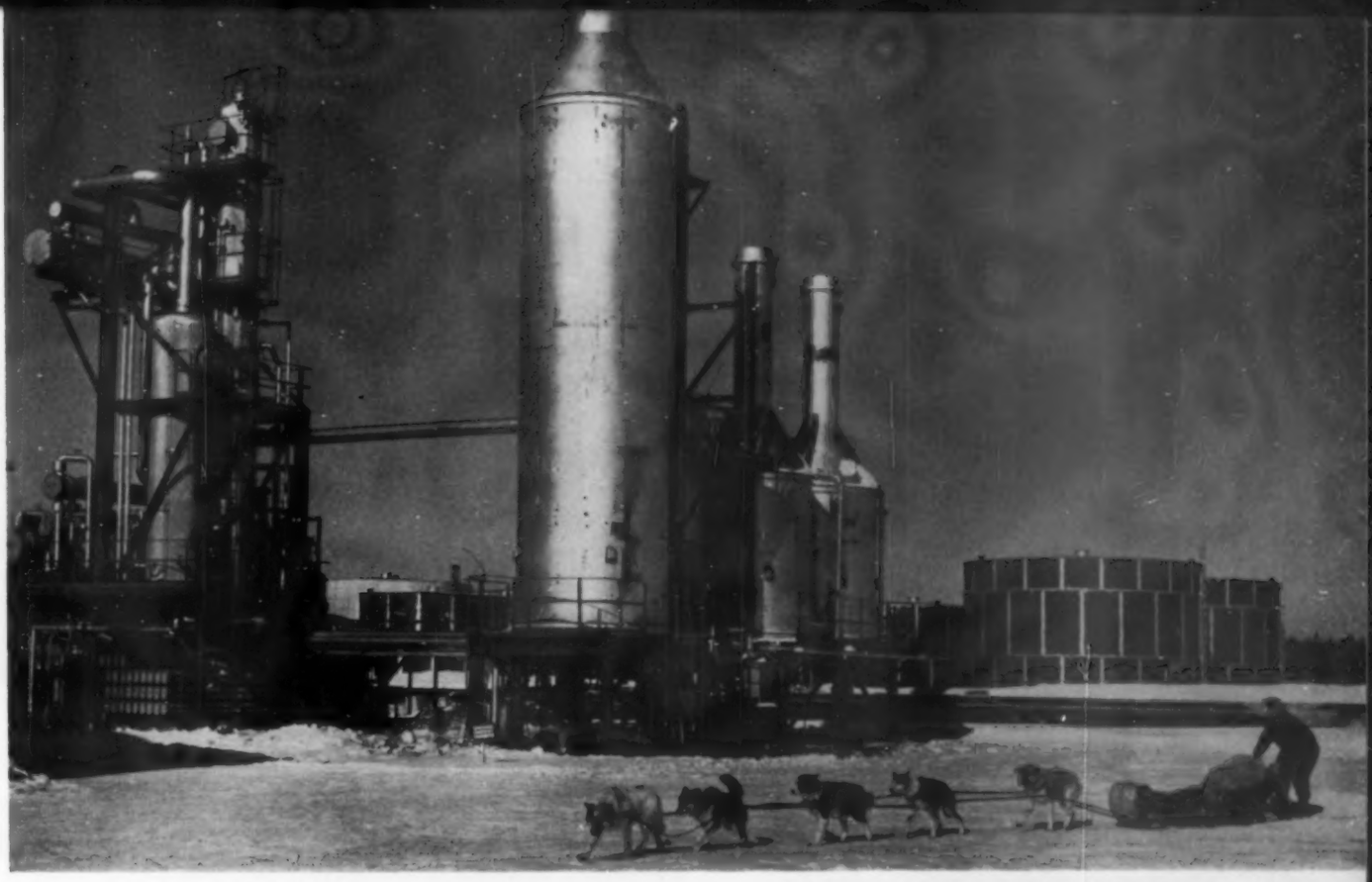
It is not the purpose of this article to discuss this latter phase, since we have no experience here beyond the exploratory operations. However, it may be of interest to mention generally just what is going on in this field.

The centrifuge method of extraction which processes sand from open pits is most advanced at present. It is probable that the hot water flotation method of extraction will eventually be successful in handling bituminous sand from open pits and that the use of detergents may be a most important refinement of this method.

In situ methods, now being considered and experimented with, are circulatory schemes involving close drilling, use of diluents and compressors, pre-firing to raise bottom hole temperatures, sonic, high frequency, thermal extraction with atomic energy as source of heat, and probably others. All these are beyond the scope of this article.

The future of the bituminous sands deposit is obviously a bit vague at present, the production of profitable oil being largely dependent upon the world political and economic situation. Overhead will no doubt be reduced in time by a highway from Lac la Biche, a railroad from Fort McMurray to Pine Point, and eventual development of what will be one of the finest timber producing regions of Alberta. Commercial fishing and tourist trade will become side industries contributing somewhat to the general development of the region. A pipeline to Edmonton, and possibly a small local refinery supplying market requirements similar to that at Norman Wells, will in time provide the outlet for production.

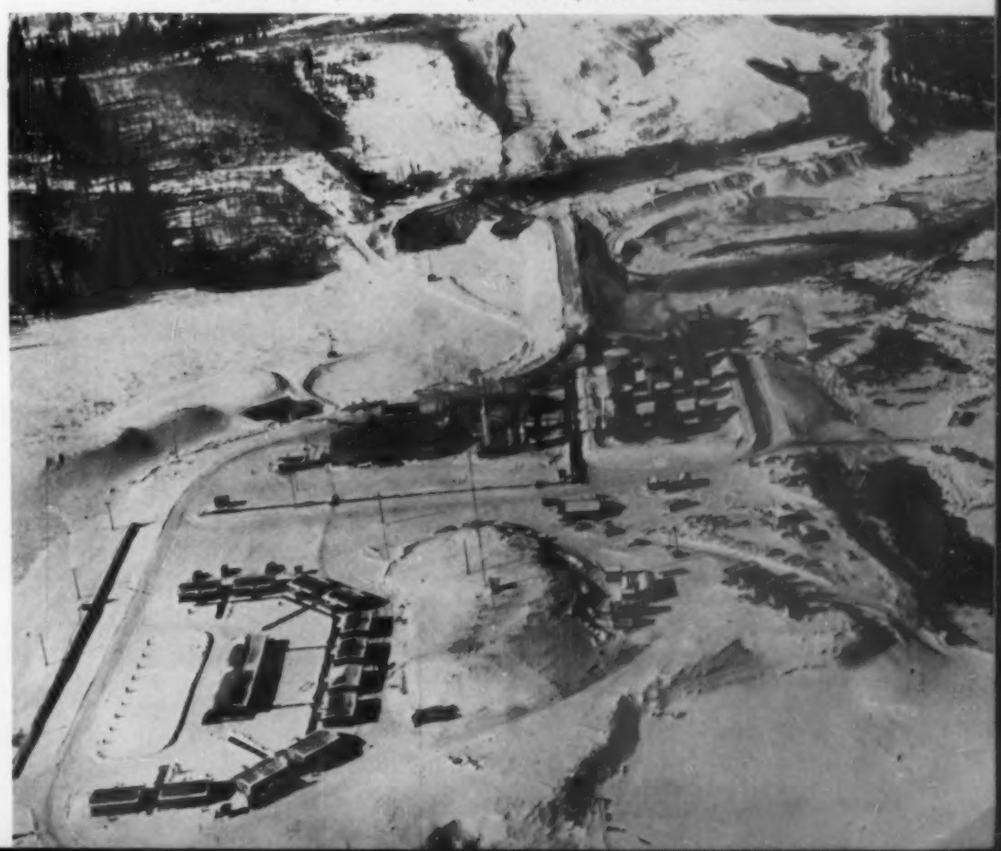
This is the last frontier in the Province of Alberta, certainly the longest in the crossing, and one of the most interesting.



Main process area at Mildred Lake, fractionators at left, heaters at right, storage in background

The Mildred Lake Athabasca research project

Aerial view of Cities Service Athabasca's $3.5 million pilot plant at Mildred Lake where long-term research is being carried out on recovery and extraction. Sands are mined from open strip along escarpment in middle background, beyond process area. All photos courtesy Cities Service Athabasca Inc.

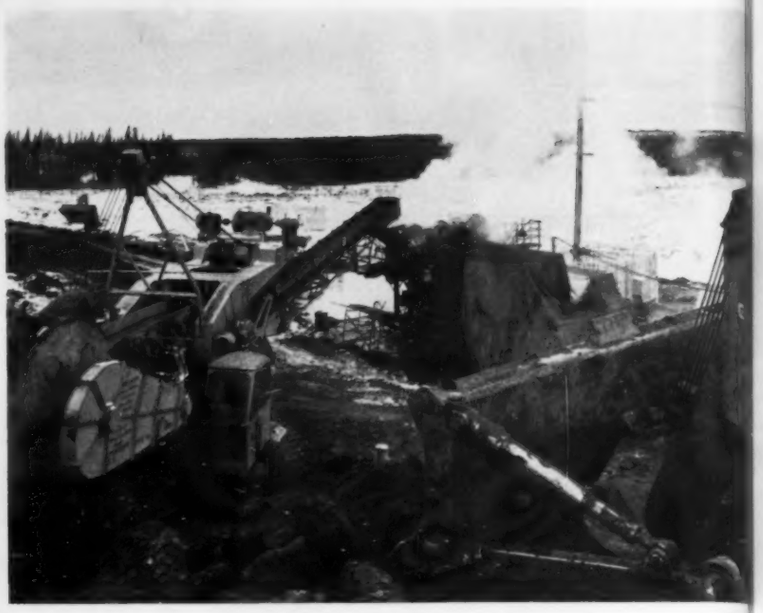


THE HUGE RESEARCH PROJECT to recover liquid hydrocarbons from the Athabasca oil sands in northern Alberta is being carried on at Mildred Lake, about 30 miles north of Fort McMurray by Cities Service Athabasca Inc. as the operator for a four-company enterprise—Imperial Oil Ltd., 30%; Richfield Oil Corp. of Los Angeles, 30%; Cities Service Athabasca Inc., 30%; and Royalite Oil Co. Ltd., 10%.

These new photographs illustrate activities at the project, which has been underway about a year, and was described in detail in WORLD PETROLEUM, March, 1960, p. 90. The processing facility includes a 3,000 b/d distillation unit and associated equipment. A unique mining "wheel," built by Krupp and which has been highly successful in surface coal mining in Europe, strips the sand from the surface.

There are two other groups actively engaged in solving the oil sands problem: Can-Amera Oil Sands Development Ltd. and Great Canadian Oil Sands Ltd. GCOS submitted an application in June to the Alberta Oil and Gas Conservation Board for approval to mine, process and market synthetic crude oil from the Athabasca

(Continued)



Above: View of power units for boom on mining wheel, extraction unit in background

Above right: Major equipment at surface includes bulldozer to clear overburden, Krupp mining wheel, and belt conveyors carrying sands to the extraction unit in center background

Right: In winter, the Athabasca River serves as the highway from Fort McMurray to Mildred Lake

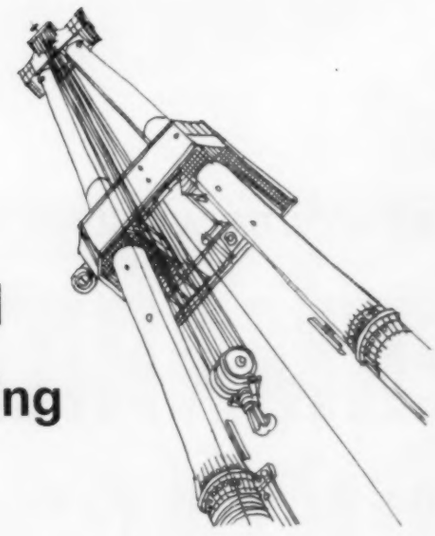
sands. About $110 million would be needed by GCOS to complete the project, which would involve the extraction of 31,500 b/d of oil and piping it to the Interprovincial pipeline at Edmonton.

The investment includes maximum price guarantees of the following three prime contractors: M. W. Kellogg Co. agreed to a maximum price of $58 million for extraction, dehydration, coking, desulfurization, hydrogen production and auxiliary facilities and buildings. Mannix Co. Ltd. gave an estimate of not more than $26 million for a pipeline to Edmonton, and Link Belt Ltd. estimated the mining and conveying system at not more than $18.7 million, including two machines to be designed in Germany.

The GCOS application indicated about two years for completion of the facilities, with 500 to 550 men on the pipeline and 800 men on work conducted by Kellogg. A permanent operating and maintenance staff for the finished plant would number 550.

The application was given a hearing in June at which time the other two groups sent representatives to intervene. No decision has as yet been made by the Conservation Board. END

Engines designed for oil drilling



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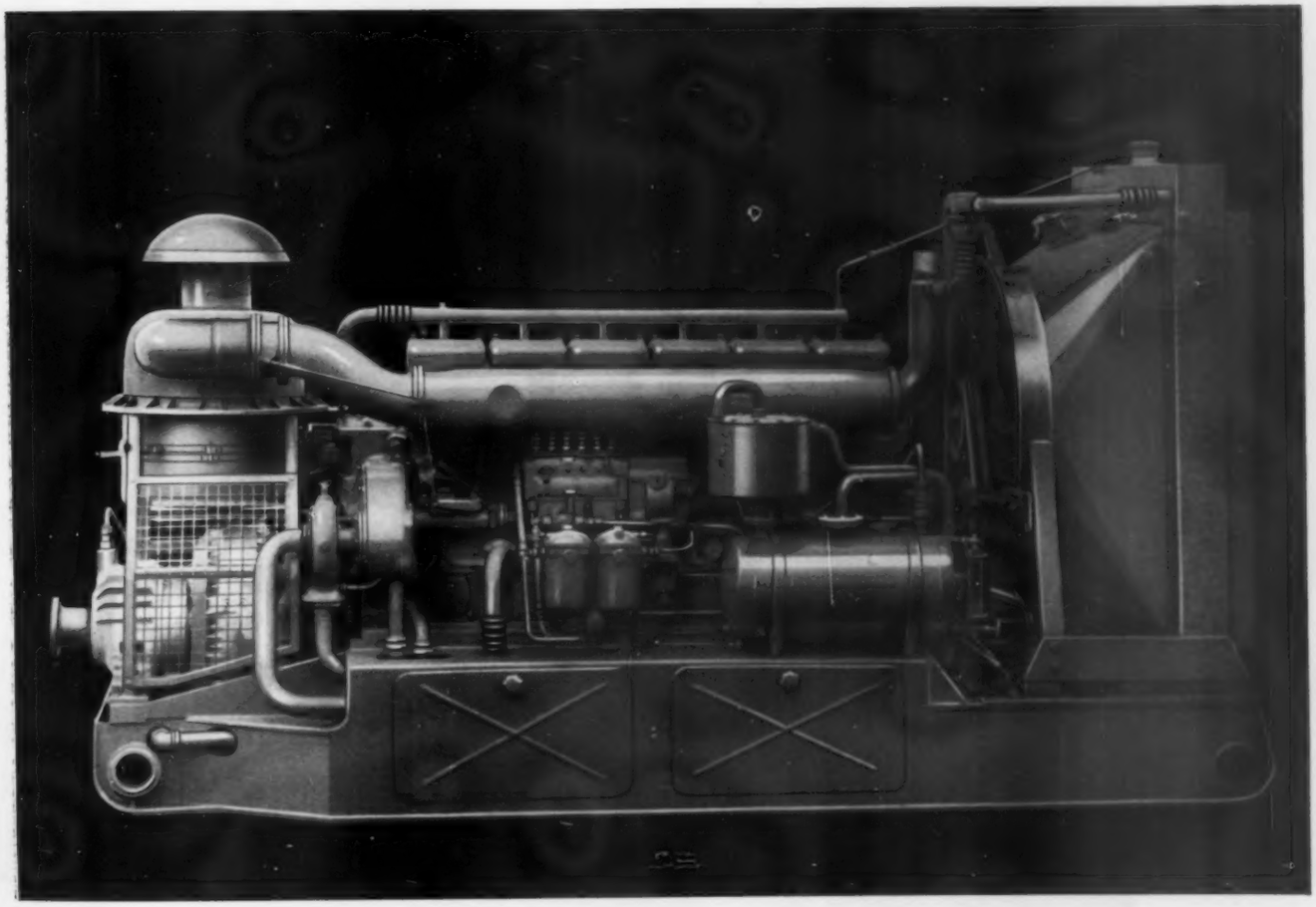

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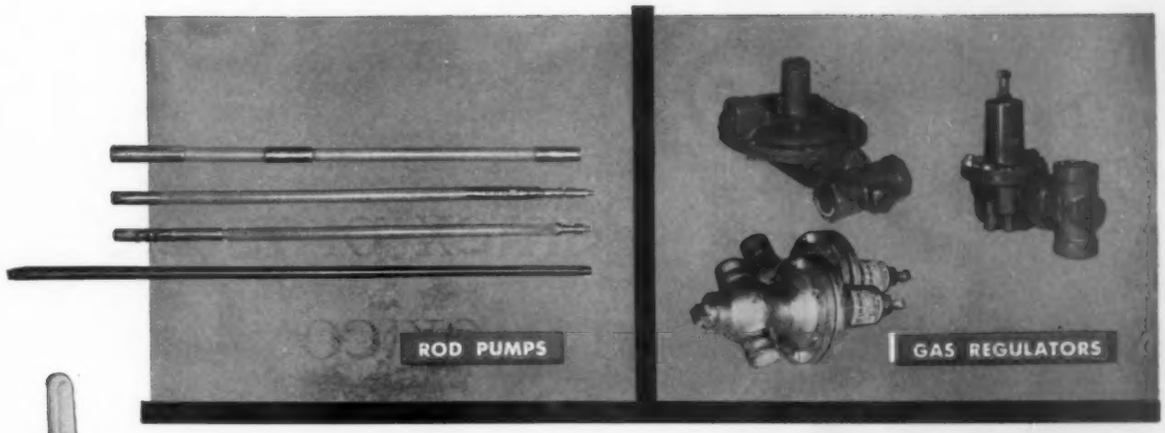

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A Pemex crew pulling tubing on a drilling well in the Poza Rica area.

Pemex progress in Mexico

Under the able supervision of its new administrator, Mexico's oil industry has undertaken an extensive modernization and expansion program aimed at fulfilling Mexico's growing oil needs.

MEXICO'S OIL INDUSTRY is showing signs of a strong revival. It is now one of Mexico's largest industries, with yearly expenditures almost as large as the entire Mexican government's. It is ably directed by Pascual Gutierrez Roldan, former head of Altos Hornos, the government's steel plant, and now Director General for Pemex.

Basic to the company's rise has been a virtual complete refinancing. With the aid of about $127.8 million in international loans negotiated by the new Director General, Pemex is beginning a massive investment program aimed at new capital expenditures committed and planned of $377,640,000 to be met from outside sources. The organization is streamlined too; where it formerly paid literally hundreds of different taxes, Pemex now pays a flat sum of 2 million pesos per day (about $160,000 or around $58.4 million per year). This approximates 12% of gross and hence does not come far from the traditional oil industry-government 50-50 split of net.

Pemex has likewise shaken off most of the subsidies it formerly paid. There remains only the bus line subsidy in Mexico City and that, too, will disappear after 1960. A substantial increase in Pemex income has resulted from higher ceiling prices on oil products sold in Mexico. Fuel oil is up, and Pemex is withdrawing its low-grade Mexolina gasoline (70-octane) from the market which formerly sold for about 55 centavos per liter (17 U.S. cents per gallon). It is to be replaced with Super Mexolina at about 80 centavos and Gasolmex at about a peso. These have 80 and 90 octane ratings respectively, low for some countries but sufficient for most Mexican drivers. Pemex is under continual pressure in the gasoline market, where demand in the Federal district alone increased by 12% during 1959. Gasoline sales are the real basic income for Pemex.

Exploration Grows. Pemex has pushed exploration rapidly and during the five year period of 1955 to 1959, inclusive, 67 new oil and gas fields were reported. All were small; a new Poza Rica, still Mexico's largest producer, still has not been found. Pemex drilled 325 wildcats in the same 5-year period. During 1960 a total of 623 wells and 4,200,000 feet of hole are planned, including all types of wells. Of these 117 are to be exploratory, according to Pemex. As of May 17, 1960, 132 rigs were running, of which 96 were Pemex rigs and 36 of them were contract rigs.

Going back some years, exploration was practically suspended at the time of the expropriation in 1938. It began again in the following year at a very low level; only two crews, one seismic and one geological, were at work in 1939. In 1944 it began to increase and a total of 14 seismic, seven surface and three gravity crews were active.

Exploration in the past five years has tested older and deeper formations. Pemex now states that 80% of Mexico's production is from fields discovered by Pemex and only 20% from fields discovered before the expropriation. A Jurassic play has opened new fields, including Tamaulipas, Constituciones and San Andres, which now produce about 65,000 b/d. This is a new development, with the best possibilities in Mexico. The Paleozoic is now the target of exploratory drilling, based on a 1958 find in the Paleozoic near Ciudad Victoria in Tampico State. Present exploration is pushing as far eastward as the Eastern Sierra Madre mountains, hoping to find Paleozoic pay in San Luis Potosi, Durango and Zacatecas States, which embrace some 90,000 square kilometers. Partly this play is based on the recent discovery of Paleo-

zoic oil in Texas, which is now over 300,000 b/d. There is a distinct lithological resemblance between the outcrops in West Texas and the Marathon Basin and the Mexican correlations near Victoria.

Recently a good discovery was made by Mexican American Independent Co., a contractor to Pemex which is owned by Pauley Petroleums, Inc. The discovery, made during 1959, was offshore in the Isthmus of Tehuantepec. Known as the Santa Ana structure, it is 70 km east northeast of Coatzacoalcos and is immediately adjacent to the shoreline. The structure, located by gravity meter surveying done in 1948 and marine seismic surveying done in 1958, is 8½ km by 8½ km in size. It is a salt dome, probably piercement type but this has not been established. The discovery well, Santa Ana 239, was the first test drilled on the structure. Total depth was 3,002 meters. The second well, Santa Ana 281, encountered salt at 2,665 meters. Total depth was 2,794 meters. Santa Ana 239 and Santa Ana 281 are both dually completed in Miocene sands; the Santa Ana 239 tested 1,680 b/d of 36 and 38 gravity oil. Santa Ana 281 tested 2,340 b/d from an accumulative sand body of 130 feet in two zones.

Natural Gas Boom. Pemex is pushing natural gas development strongly, and a natural gas pipeline network is under way to supply all Mexico's industrial centers. The 1960 budget for gas line construction is 750 million pesos (about US$60 million). The biggest line is the 491-mile, 24-inch line from Pemex city in the south through the industrial spine of Mexico to the capital. A $40 million loan from U.S. banks has financed the line. It will have a capacity of 500 million cubic feet daily and will be in operation late in 1960. Two Mexican contractors are working on it, with over-all supervision by the Fish interests. Another project calls for two lines Monterrey-Torreon, to be completed this year. Constructors are Cie. Constructora Inde and Protecsa.

Pemex now is eyeing a gas line to California, a shorter distance than from Texas or Louisiana, but has no definite plans yet.

Production Plans. Mexican production was 263,692 b/d during the first four months of 1960. This compares with an average 264,033 b/d production during 1959. These figures are exclusive of condensate production, which is sometimes included in Mexican figures. Some 18% of the country's production is from Jurassic sediments which were not producing oil four years ago.

Present production levels are still quite far below the maximum production levels of 1921. In that year crude production reached a high of 536,986 b/d average throughout the year. From that year onward, production continued down, however, until 1946 when it began a gradual rise once again.

Poza Rica District. In the Poza Rica district, still Mexico's richest, there are 24 oil and gas fields. None of them are strictly gas fields; all contain some oil. The newest find is Dorial field, now under investigation. A total of 37 rigs are in use over the three main groups of fields, of which 26 belong to Pemex and 11 to contractors. Out of over 1,000 wells producing there are only 13 workover rigs in operation, since most wells need very little attention.

One of the groups is Talabria, a Middle Cretaceous field, with a porosity of about 11% with low to medium permeability. The five Poza Rica fields constitute an important group, some 32 square miles in area with 450 producing wells, averaging 2,400 to 2,500 meters deep. It is still being developed to the southeast. Recoverable reserves are 1.219 billion barrels. Cumulative production is 762 million barrels. It is producing 75,000 b/d now. Jilapa and other nearby areas are now being developed. Wells there average 6,300 ft deep.

An extension to the Golden Lane was found in 1952, in the Middle Cretaceous. It is 100% water drive, containing heavy oil, becoming lighter to the south. Wells are 2,360 ft deep in the north, going down to 7,300 ft in the southeast.

A third group is in the Jurassic. It holds light oil in an Oolitic limestone pay, also is almost 100% water drive. This is known as Red Beds production and is not related to structure.

Poza Rica reserves are about 1.77 billion barrels. Cumulative production so far is about 1,002 billion. Gas production (cumulative) is about 1.17 trillion cubic feet and reserves are around 2.78 trillion. There are 1,040 wells in the district now, including wildcats. Standard drilling techniques are being used.

Artificial lift is being used in this area, including gas lift. It was found in 1951 that Poza Rica production must be cut back sharply to avoid reservoir damage, and now 40% of production and 430 wells are on artificial lift.

Pressure maintenance is now used extensively in Golden Lane, especially in Poza Rica which has had a large pressure drop in the 1st 30 years. Pemex has injected 100 billion cubic feet of gas and 308 million barrels of water in the flanks. Bottom hole pressure is coming up, on the average. Gas injection began at San Andres in 1959; 809 million cubic feet has been injected so far at the rate of 25 to 40 million cubic feet per day.

Some 6,000 b/d are refined for local use, the remainder is shipped out. Pemex has a 24,000 b/d desalting plant treating 185 million cubic feet of gas. They are recovering many products, including 117 metric tons of sulfur.

Pipelines from Poza Rica district include two oil lines to Mexico City and one gas line. When the large gas line from Ciudad Pemex is complete the gas line will be taken out of operation since enough gas will be fed Mexico City by the Ciudad Pemex line.

Pemex is providing all public services around its installations, including electricity, AM and FM radio, etc. Electricity will be taken over by the government soon. Meanwhile, Pemex has a 30,000 kw plant, and the government is planning a 15,000 kw plant. Pemex will have to pay for the government installation when it comes in. Pemex has a 25,000 b/d water treating plant, and also pumps one million b/d of water.

Adolfo Lopez Mateos, president of Mexico. The present administration has focused attention on Mexico's oil supply, and the Pemex budget approximates that of the entire federal government in 1960.

Pemex has no oil service contractors and provides its own perforating, electric logs, wire line work and well stimulation. It has a service company for cement jobs, however. Pemex also does its own core analysis.

Oil accumulations are stratigraphic. Ultimate reserves are perhaps double present levels, probably not more since Pemex will have to find another Poza Rica to do better and Pemex officials believe the odds are against that. Pemex estimates it will drill 500 to 1,000 wells in this zone in the future, and plans about 150 in 1960, of which 18 to 25 are wildcats.

Pascual Gutierrez Roldan, director general of Petroleos Mexicanos under whose supervision present expansion plans are being carried out. He is responsible for the successful administration of the government's steel plant, Altos Hornos.

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View of the atmospheric distillation unit at Salamanca refinery, one of Pemex' modern plants.

San Andres is producing about 29,000 b/d now, the first Jurassic production in Mexico, and has 189.575 million barrels of proved and recoverable reserves, using a 50% recovery factor. Hallazgo field is 98 million barrels reserve, proved and recoverable, at the 50% factor.

Pemex is now producing about 100 million cubic feet daily of gas for injection, and is using 80 million cubic feet daily for gas lift in San Andres.

Tampico Area. Mexico's famed "Faja de Oro" or Golden Lane, is one of three producing zones in the Tampico area. There are now 17 rigs operating in the area, soon to be raised to 34, of which 10 are on exploratory work and 17 on development drilling. Approximate depth of wells is 5,000 to 12,000 ft for wildcats, development wells average 6,000 ft. During 1960 Pemex plans to drill 220 wells in this Golden Lane.

Ebano Panuco and Tamaulipas fields are the other producing areas. While Golden Lane has produced more than one billion barrels, Panuco has produced almost as much—about 850 million barrels since its discovery in 1904. About 6,000 wells have been drilled, of which 700 are still producing. Production is declining a moderate 3% yearly. Golden Lane, after 52 years, is still producing about 5,200 b/d.

Tamaulipas was discovered in 1955 and 169 wells have been drilled, 160 of them productive. It will produce 50,000 b/d by the end of 1961 and will have 200 more wells. The field has 11,000 acres of productive area and will recover about 700 million barrels. Pemex also plans to drill 120 wells in the Cretaceous section of Tampico.

The Barcedor field, with 6 wells, has 30 locations staked and will produce about 10,000 barrels daily by the end of 1960. The area resembles Poza Rica geologically. Three wells are making 1,000 b/d, a fourth well is doing about 200 b/d.

Pemex is using fracturing and all well stimulation procedures. They expect to obtain about 50% recovery in Tampico by using miscible flood, 40% by water flood. Projects are going on in both methods.

A pipeline to Mexico City is underway from the Golden Lane and the North District. In eight years Tampico will double its production, and triple its drilling. Pemex has 100 proved Jurassic locations in this area.

Refining Plans. Pemex plans about 240,000 b/d in new refinery capacity in such plants as the new tile-walled Ciudad Madero refinery near Tampico, whose 135,000 b/d production will retire about 103,700 b/d in old installations around it which date back to the pre-1938 years.

Lubes are part of Pemex's expansion plans, and there is a large investment planned in other down-stream processing, such as hydro-treating, polymerization, catalytic cracking, and alkylation.

Refineries in Mexico at present total eight, and their capacities total 399,000 b/d of crude charging with 60,000 b/d catalytic cracking. A description of each plant follows:

ATZCAPOTZALCO, Mexico City. Crude capacity: 100,000 b/d. Thermal cracking, 14,500 b/d. Model IV Fluid catalytic cracking, 25,000 b/d. Alkylation, 3,000 b/d. Desulfurization, 29,000 b/d. Polymerization, 800 b/d.

MADERO, Tampico. Crude capacity: 120,000 b/d. Vacuum distillation, 60,000 b/d. Visbreaking, 9,000 b/d. Fluid catalytic cracking, 25,000 b/d. Perco Cycloversion, 15,000 b/d. Perco desulfurization, 18,000 b/d. Polymerization 2,000 b/d. Treating, 10,000 b/d. Asphalt, 5,000 b/d. Wax, 40 ton/day. Sulfur recovery, 30 ton/day. Expansion plans are for a completely new $45 million, 135,000 b/d refinery in Tampico to replace eventually all three present facilities. The 120,000 b/d capacity at Madero represents the first phase.

MATA REDONDA, Tampico. Crude capacity: 12,000 b/d. Thermal cracking, 6,000 b/d.

MINATITLAN. Crude capacity: 85,000 b/d. Thermofor catalytic cracking, 10,000 b/d. Visbreaking, 6,500 b/d. Polymerization, 1,400 b/d. Lubes, 800 b/d. Construction: a new topping unit of 50,000 b/d capacity, for completion mid-1961.

POZA RICA. Crude capacity: 6,000 b/d. Under construction: a new 15,000 b/d topping unit and Perco catalytic reforming.

REYNOSA. Crude capacity: 10,000 b/d. Thermal cracking, 1,500 b/d. Natural gas plant, 300 mmcf/d. Gas plant is being enlarged to 600 mmcf/d.

SALAMANCA. Crude capacity: 40,000 b/sd. Vacuum distillation, 14,000 b/sd. Thermal cracking, 6,000 b/sd. Perco desulfurization, 11,000 b/sd. MEK dewaxing, 3,000 b/sd. Propane deasphalting, 5,800 b/sd. Furfural extraction, 6,000 b/sd. Wax percolation, 900 b/sd. Clay contacting 2,300 b/sd.

Petrochemicals Pushed. Pemex has extensive plans for petrochemicals. Under provisions of a 1959 law, Pemex can retain control of basic materials from which petrochemicals are made, while encouragement is given to private industry to build the plants for production of intermediates and finished products. Three new petrochemical plants are currently on stream, and 14 more are in the works. About $112 million is budgeted for petrochemicals by Pemex, and Pemex expects demand to outstrip supply even with this new capacity. Officials point to their recent production of sulfuric acid. There was practically no demand when the facilities were built, but within three months after H_2SO_4 became available the demand had far outrun supply. Similarly, anydrous ammonia has no demand now, but Pemex will build three plants with 200 tons production each at Salamanca, Chihuahua and Minatitlan.

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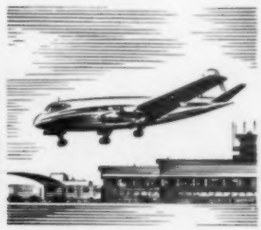

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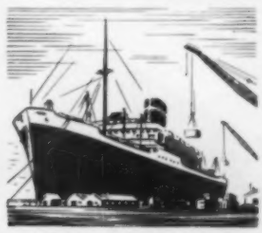

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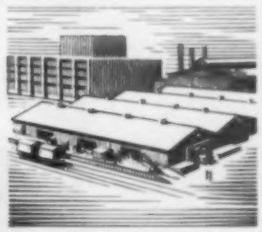

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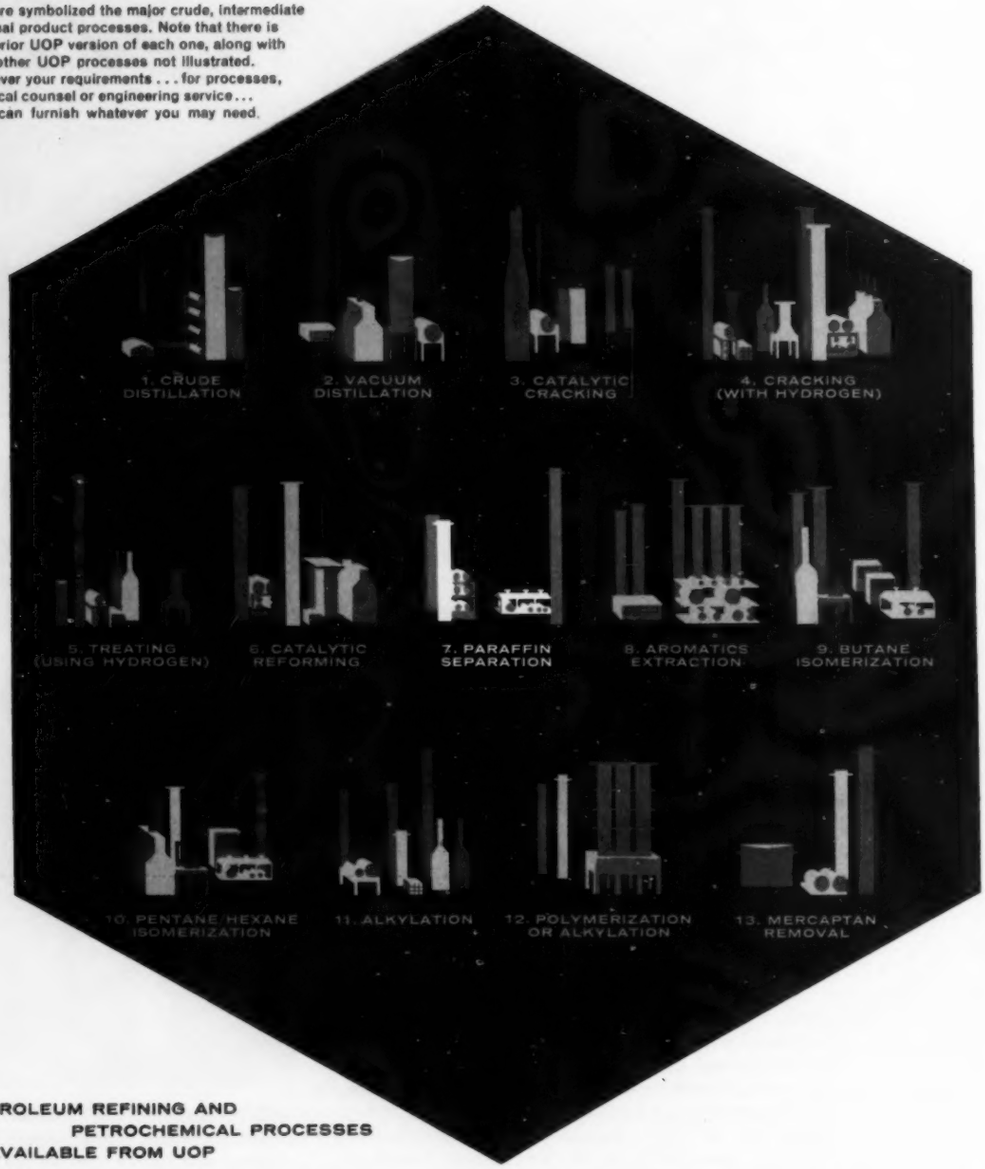

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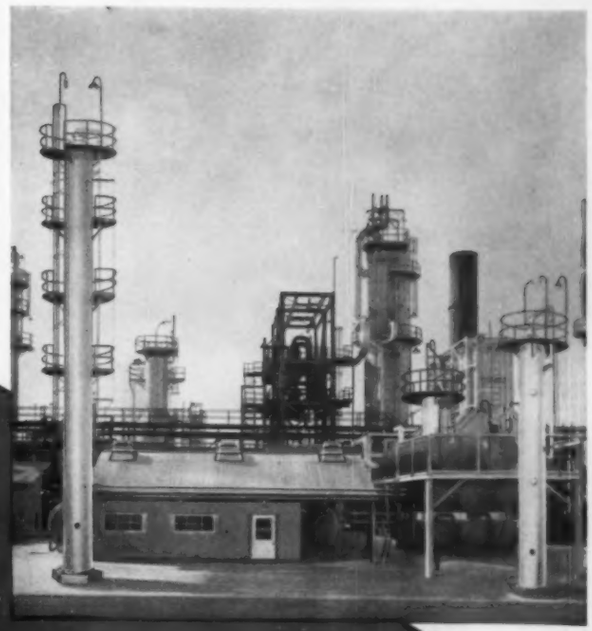

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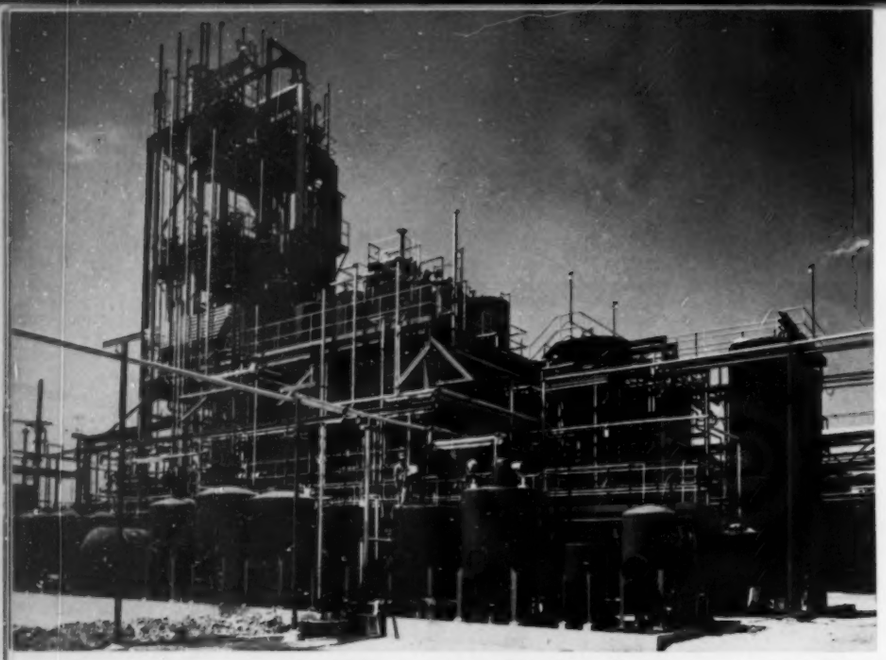
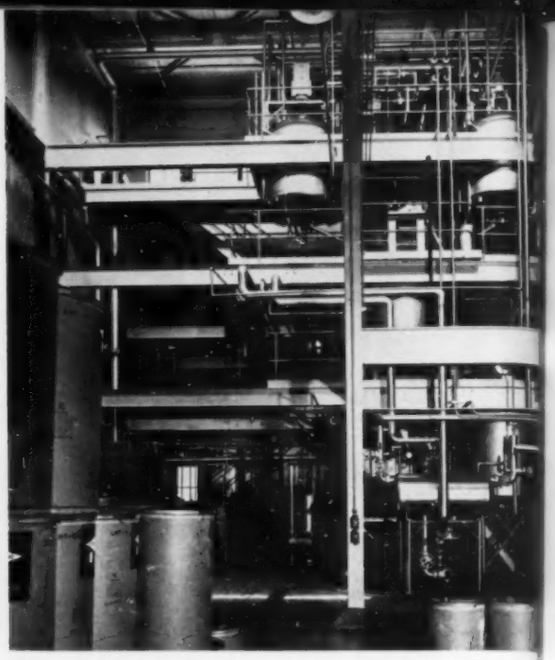


Plant for the production of bisphenol-A. Photo courtesy Dow Chemical Co.



Interior of Dow Chemical's bisphenol-A plant at Midland, Mich.

Petrochemical raw materials for epoxy resins

by Peter W. Sherwood*

RECENT MARKET' SURVEYS indicate that epoxy resins are about to enter a period of rapid sales growth. One such study[1] predicts that the total USA market for epoxy resins will rise from 29 million lb in 1958 to 88 million lb in 1963.

Carried along with the upward sales curve for epoxies will be the output of the two key raw materials for this family of resins: bisphenol-A and epichlorohydrin. Both of these intermediates are products of the petrochemical industries. Bisphenol-A is a condensation product of phenol and acetone, and epichlorohydrin is obtained from propylene via its chlorination product, allyl chloride.

Factors other than the rising demand for epoxy resins will have crucial influence on the supply-demand situation for bisphenol-A and epichlorohydrin. Thus, comsumption for the former will be boosted by the anticipated growth of the market for polycarbonate resins, a relatively new family of polymers which are the second significant consumer of bisphenol-A. To meet the growing need, considerable new construction of bisphenol-A manufacturing facilities is underway. Present plans would raise plant capacity from 45 million lb/yr in late 1959 to 70 million in 1961, barely enough to meet requirements of 74 million lb/yr anticipated for that year.

On the other hand, no shortage of capacity is in sight for epichlorohydrin. This product is an intermediate in the classical (chlorination) commercial method of glycerine synthesis. Present installed glycerine capacity, based on the chlorination route, is reported at 182 million lb/yr, and announced plans will add another 35 million to this capacity by early 1961, bringing the total to 217 million lb/yr glycerine, equivalent to about the same volume of epichlorohydrin (about 1.05 lb epichlorohydrin is consumed per pound gylcerine produced).

It must be noted that epichlorohydrin produced as intermediate for glycerine is not of sufficient purity to be utilized directly in epoxy resin manufacture. However, the upgrading step is relatively simple and

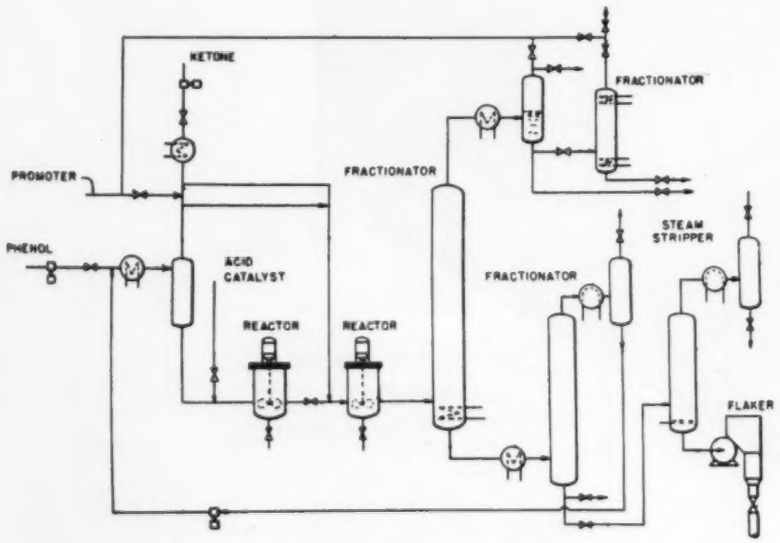


Fig. 1—Continuous process for the manufacture of bisphenol-A.

*Chemical Engineer, White Plains, N. Y.

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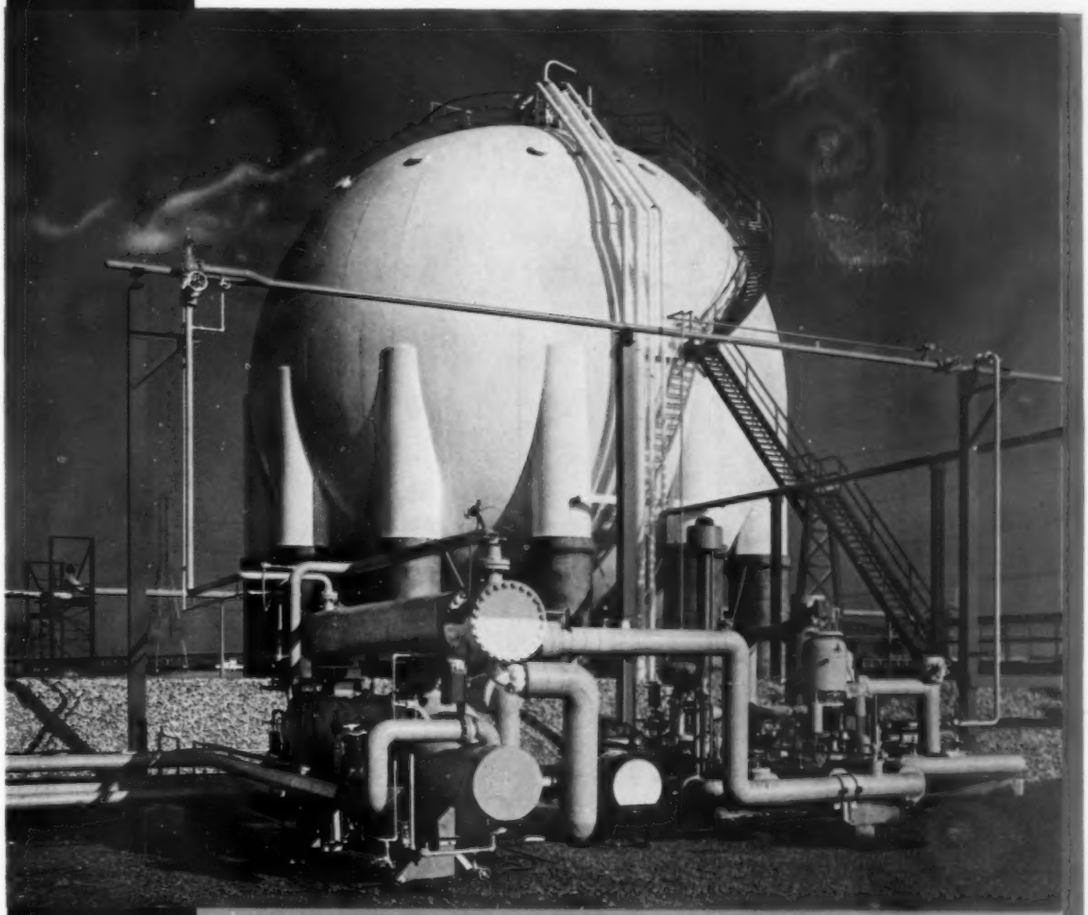

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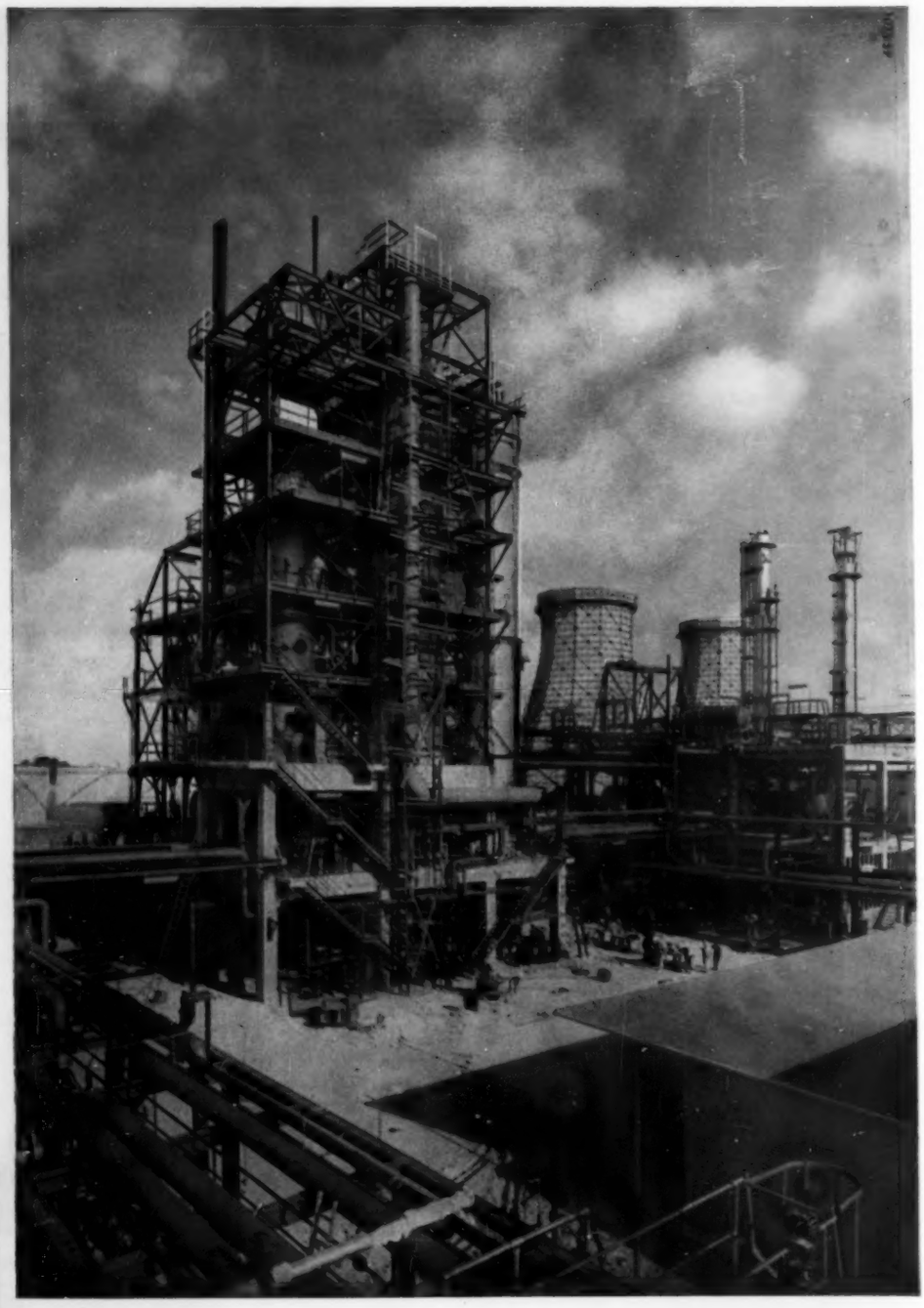

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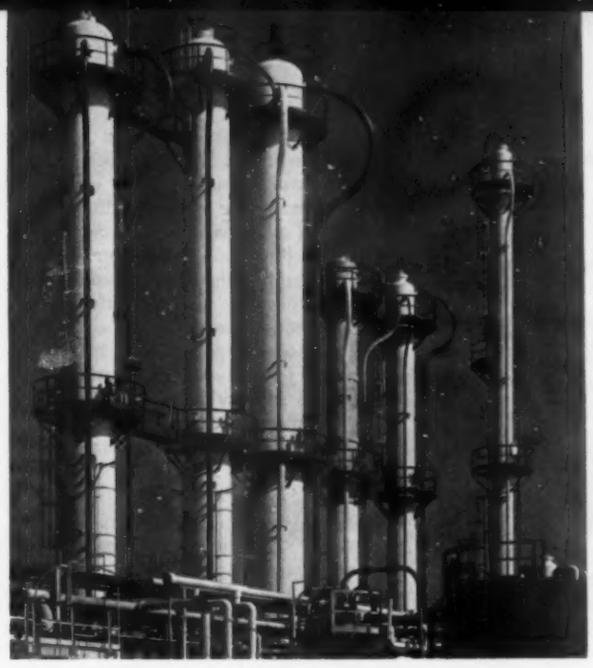


Two views of Dow Chemical's epichlorohydrin-glycerine production facilities at Freeport, Texas.

the potential availability of epichlorohydrin is thus essentially the difference between capacity (i.e. about 225 million lb/yr in early 1961) and demand for glycerine production from this source.

Just what this demand for epichlorohydrin-derived glycerine will be depends on three key factors: (1) total market for glycerine, (2) sales of natural glycerine, and (3) impact of Shell's new (acrolein-based) route to synthetic glycerine in which epichlorohydrin does not figure as intermediate. A 35 million lb/yr glycerine plant based on this novel process was slated for start-up in late 1959 at Norco, La. All told, USA production of synthetic glycerine (epichlorohydrin-plus acrolein-based) is expected to be 135 million lb in 1960, 200 million lb in 1965.

These market aspects will be considered below in some more detail. Suffice it here to say that the posted price for epichlorohydrin was reduced from 30 to 27¢/lb in early November 1959. This timing coincided with transfer of a part of Shell's glycerine production from the allyl chloride-epichlorohydrin-based plants to the acrolein-based method of synthesis and has thus been viewed by members of the industry as an indicator to the increased availability of epichlorohydrin capacity which has resulted from the shift.

From this summary, it is evident that there is a fairly complex interplay of market and technical factors in the petrochemical base materials for epoxy resins. It will be the purpose of this article to provide some details on the economic factors involved and to report on the status of the technology involved in the manufacture of the two key intermediates for epoxy resins: bisphenol-A and epichlorohydrin.

Economic Aspects

Epoxy resins did not reach significant commercial volume until about 1950. Output in 1952 was about 7-8 million lb and growth rate during 1952-9 averaged 40% per year.

Having reached commercial maturity, this percentage rate of growth will not continue but considerable increase in volume is forecast. One recent study[2] predicts that USA consumption of epoxy resins in 1966 will be 85 to 95 million lb, more than twice the 37-42 million lb estimated for 1959.

Actually, the outlook for 1966 may be very much better—a forecast as high as 120 million lb has been ventured. Main question mark is the commercial adoption of epoxy resins in five new use areas, to wit: patching compounds in lieu of solder (3-10 million lb), nonslip highway coatings (0-5 million lb), printed wiring finishes (0-2 million lb), cement block glaze coatings (3-8 million lb), and furniture coatings (6-26 million lb).

These new fields of application are in addition to the fields which now constitute the market and which are also slated for expansion. Breakdown of consumption[3] in these end uses is shown in Table 1.

It is evident that surface coatings constitute the lion's share of the market for epoxies. In this field, there are five major areas of application: auto primers, appliance primers, container coatings, pipeline coatings, and special maintenance coatings.

Different favorable properties make epoxies attractive in various end use areas. Thus, Kinsley[1] pointed out the several main characteristics which cause consumers to choose epoxy resins: (See Table 2.)

Of course, in each of these fields, competitive materials exist and the relatively high cost, as well as the need for special application techniques for epoxies must be offset by superior characteristics both in the principal required property and in secondary behavior factors. Competition stems not only from existing materials but also from materials in development. Among the latter, attention has been attracted by the chemically related epoxide resins which have recently been introduced on a commercial scale.

At this writing, six U. S. producers satisfy the market for epoxy resins. In leading position is Shell Chemical with a 1959 sales volume estimated at 17.7 million lb. Second are Ciba and Devoe & Raynolds (7 million lb each). These are followed by Union Carbide, Reichhold Chemicals, and Dow Chemical, in the order stated. This group is about to be joined by Food Machinery and Chemical Co.

From the viewpoint of demand for petrochemical intermediates, the total growth rate of epoxy resins is matched in importance by the type of epoxy resin which will capture the bulk of the market, an aspect on which the outlook is somewhat hazy. Typically, production of 100 lb of liquid epoxy resins (ex additives) will consume 63.5 lb epichlorohydrin and 74.5 lb bisphenol-A. For the manufacture of 100 lb of solid resin, raw materials requirements are typically 41 lb epichlorohydrin and 81.5 lb bisphenol-A.

Bisphenol-A: At this writing, some 93% of bisphenol-A output is consumed by epoxy resins. The remaining market is taken up by polyesters, ultraviolet absorbers, brake fluids, and pilot plant quantities of polycarbonates.

The last-named end use offers the only major potential use area for bisphenol-A outside epoxy resins. Activity in polycarbonates is centered on Mobay Chemical Co., which will bring a 10 million lb/yr

Table 1—USA End Use Distribution for Epoxy Resins (million lbs)

	1958	1959	1963
Coatings	21.2	25.8	48.4
Tooling	2.5	3.6	6.2
Electrical	2.4	3.3	8.9
Laminating	1.3	1.8	3.9
Adhesives	1.2	1.7	3.7
Other	0.4	1.2	17.0

Table 2—Favorable Characteristics of Epoxy Resins

End Use	Characteristics
Coatings	Chemical resistance
Plastic Tooling	Strength, dimensional stability, ease of use
Potting and Encapsulation	Good electrical properties
Adhesives	Good bonding properties
Laminates	Good adhesion and strength characteristics

Table 3—Bisphenol-A Producers and Plant Capacities (million lb/yr)

Company & Location	Late 1959	Early 1961
Shell Chemical, Houston, Tex.	45	45
Union Carbide Plastics, Marietta, Ohio	—	25
Dow Chemical, Midland, Mich.	15	30
Monsanto, St. Louis, Mo.	10	15
	70	115

plant on stream in early 1960, and on General Electric Co. which expects to start up polycarbonate production in the third quarter of 1960 in a plant at Mount Vernon, Ind. rated at "upward of five million pounds per year." So far, however, the entire growth in bisphenol-A output has been impelled by epoxy resins. Total production has risen from an estimated 25 million lb in 1956 to 43 million lb in 1959, and is expected to reach 115 million lb by 1965[4]. By that time, polycarbonates are expected to consume 20 million lb bisphenol-A, while epoxy resins will call for 80 million lb.

Manufacturing capacity for bisphenol-A is just now going through a major expansion phase in anticipation of the growing market. Table 3 shows the line-up of producers before and after completion of current expansion programs.[4, 5]

Thus, expansion projects now underway will raise plant capacity to the sales level anticipated by 1965. How soon the slack will be taken up depends on the actual gain made by epoxy resins and on the big unknown, the extent to which polycarbonate resins find acceptance once they become commercially available.

Epichlorohydrin: Except as intermediate for glycerine production, epichlorohydrin's only significant outlet is the manufacture of epoxy resins. Supply situation of the intermediate is certainly adequate.

In 1959, total demand for epichlorohydrin plus glycerine (natural and synthetic) has been estimated at 260 million lb. Of this total, glycerine consumption was about 230 million leaving 30 million lb epichlorohydrin.

Another way to estimate 1959 epichlorohydrin demand for epoxy resins is to consider output of these resins, which is estimated at 54 million lb. Bisphenol-A required for this outlet is estimated at 40 million, and by interpolation into typical compositions of epoxy resins, epichlorohydrin demand in 1959 may be estimated at 32-35 million lb.

Table 4—Synthetic Glycerine Producers (million lb/yr)

Company & Location	Glycerine capacity	Remarks
Shell Chemical Houston, Texas	90–120	Part of epichlorohydrin capacity is at Norco, La.
Dow Chemical, Freeport, Texas	72	
Olin-Mathieson, Doe Run, Ky.	30–35	Will start up early in 1961
Shell Chemical, Norco, La.	35	Uses acrolein route, consumes no epichlorohydrin

All told, demand for synthetic glycerine is expected to be 135 million lb by 1960. Assuming that 25-35 million of this will be manufactured by Shell Chemical Co.'s new acrolein route, the demand for epichlorohydrin for synthetic glycerine should be no more than 110 million lb (it takes about 1.05 lb epichlorohydrin per lb glycerine). This compares with installed capacity of about 180 million lb/yr, leaving 70 million lb/yr epichlorohydrin available for epoxy resins.

There are today two producers in the epichlorohydrin-synthetic glycerine field, and a third company is building manufacturing facilities.[6] (See Table 4.)

Raw Materials Aspects

The following raw materials are key requirements in the manufacture of bisphenol-A and epichlorohydrin: Bisphenol-A; phenol and acetone (furthermore, a noncommercial process has been reported in which cumene hydroperoxide is the starting material): epichlorohydrin; propylene, chlorine, and lime. Of these materials, propylene, phenol, and acetone are part of the petrochemical area.

Technological Aspects

Bisphenol-A: The commercial process for bisphenol-A synthesis involves the acid-catalyzed, liquid-phase condensation of phenol acetone. (See Equation 1).

It is noted that both of the starting materials are obtained as co-products in one (of four) commercial methods of phenol synthesis, namely the cumene hydroperoxide route. The suggestion has therefore been made that bisphenol-A be manufactured directly from intermediate cumene hydroperoxide, using one of two different approaches. (See Equation 2).

The method suffers at present from commercially untenable low yield (order of 30-35%). Our discussion of processing techniques will therefore be limited to the commercially proven approach, which is represented by Equation 1.

Condensation of Phenol and Acetone: The reaction of phenol with acetone to yield bisphenol-A (Equation 1) is carried out in the liquid phase. It can be promoted by either alkali or acid catalyst.

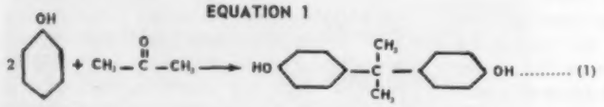
In point of fact, alkali catalyst is not employed commercially. Reaction in the presence of strong alkali is accompanied by considerable resinification and decomposition, especially during the distillation of unreacted phenol from bisphenol-A which takes place as one of the purification steps.

One alkaline catalyst which is stated to be free of this drawback is sodium phenate.[7] With this catalyst, bisphenol yield as high as 89% is reported. However, it is necessary to employ sodium phenates in high concentration, a minimum of one mole per mole phenol is called for. Other problems include a very long reaction time (upward of 15 hours at 165 C) and the necessity of springing phenol from the sodium phenate during acidification in the course of product purification.

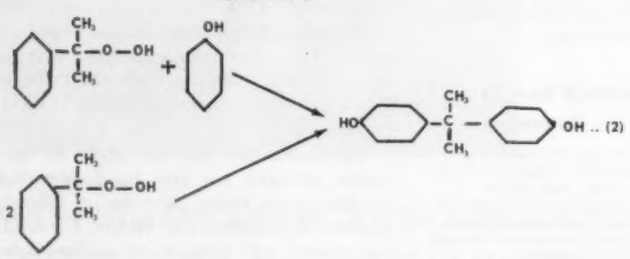
In commercial practice, the catalyst is a strong mineral acid, most commonly hydrogen chloride. Among acidic condensation agents which have been employed successfully in bisphenol synthesis, mention might also be made of sulfuric acid, hydrobromic acid, phosphoric acid, sulfur dioxide, p-toluene sulfonic acid, and boron trifluoride. In general, good condensation is accomplished in the presence of acids which have a dissociation constant greater[8] than 10^{-3} and which are soluble in liquid phenol.

Hydrogen chloride and hydrogen bromide have dual advantage over a number of other acid catalysts: (a) their use results in relatively few side reactions and (b)

EQUATION 1



EQUATION 2



Synthesis of Glycerine Epichlorohydrin

Equation 3a

$$CH_3 - CH{=}CH_2 + Cl_2 \longrightarrow Cl - CH_2 - CH{=}CH_2 + HCl$$

Allyl chloride

Equation 3b

$$Cl - CH_2 - CH{=}CH_2 + H_2O + Cl_2 \longrightarrow ClCH_2 - \underset{Cl}{CH} - \underset{OH}{CH_2} + HCl$$

"Dichlorohydrin"

Equation 3c

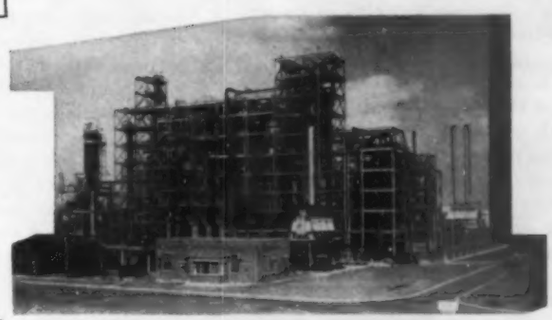
$$ClCH_2 - \underset{Cl}{CH} - \underset{OH}{CH_2} + Ca(OH)_2 \longrightarrow Cl - CH_2 - \underset{O}{CH} - CH_2 + CaCl_2$$

Epichlorohydrin

KELLOGG BUILDS FOR I.C.I. EXPANSION

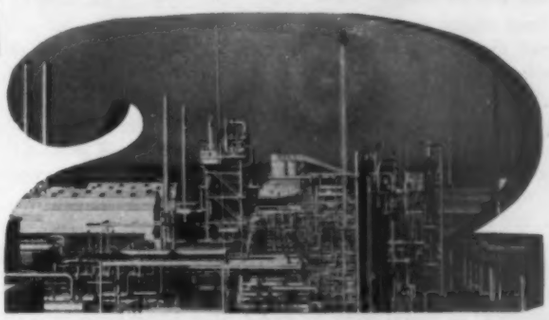
1951

Recent completion of Imperial Chemical Industries' third olefin plant at Wilton, England, has made these Works the largest petrochemical venture outside the United States. With a current output of 110,000 tons per year of high-purity ethylene, and a potential output of 140,000 tons, I.C.I. Wilton is an outstanding example of engineering cooperation.



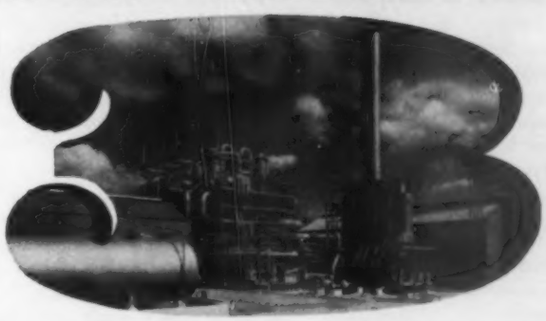
1956

The first plant was commissioned in 1951, and was the first full-scale adoption of the then novel process of oil pyrolysis developed in the Kellogg Laboratories. Its success led to the addition of No. 2 plant in 1956, and then to this latest extension, representing a 60% increase in olefin capacity, in 1959.



1959

Cooperation between client and contractor is the keynote of Kellogg's contribution to chemical engineering. The Wilton Olefin Plant is the largest in the world based on liquid feedstock. Kellogg is proud to have been associated with its development.



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these volatile catalysts are readily removed from the reaction product. Of the two, hydrogen bromide causes considerably greater acceleration of the reaction than does hydrogen chloride.[9]

In order to achieve comparable reaction rates with hydrogen chloride, it is necessary to use this material in greater concentration and to add a sulfur-containing compound, such as hydrogen sulfide, mercaptans, or mercapto acids which act as promoters. Of the various sulfur promoters which have been tested in this connection, particular usefulness is reported for methyl mercaptan.[8, 10] Advantages of this particular compound include (1) ability to reduce reaction time so significantly that a continuous process becomes feasible, (2) effectiveness in low concentration, (3) absence of by-product formation or product disintegration, and (4) high volatility which permits complete removal of this sulfur promoter from the product.

By using sulfur compounds as promoters, yield in excess of 90% is obtained within a residence time of only one-half hour (Ref. 8 claims a yield as high as 98.8% in the presence of HCl and 0.5% methyl mercaptan). Such promoters also tend to desensitize the reaction against the otherwise major effect of changes in the operating variables.

Typical concentration of catalyst in the reaction mass is 6% hydrogen chloride and 0.5-1.0% methyl mercaptan. The catalyst may be recovered readily from the reaction product and is recirculated.

Aside from choice and concentration of catalyst and promoter, key operating variables affecting the yield of bisphenol-A are the ratio of reactants (phenol:acetone), reaction temperature and contact time.

Particularly crucial is the effect of reactants' ratio. While the stoichiometric ratio of phenol to acetone is 2, yield considerations call for substantially higher ratios. Perkins[11] reports that, at otherwise comparable conditions, the yield of bisphenol-A rose from 71 to 85.9% of theory as the reactants' ratio was increased from 2.5 to 3.7.

Other workers (Ref. 10) call for ratios higher than 5:1. Very high rates of phenol to acetone, and corresponding yield improvement is obtained in multistage operation. In this approach, only a portion of the total acetone is fed to each stage. For two-stage operation, Williamson[10] reports particularly effective suppression of side reactions when about one-half of the ketone is charged to each of the stages. With an overall feed ratio of 10:1, this approach permits a starting ratio of 18-20:1 in each of the reactors.

Operating temperature can cover the range 10-80 C. Best results (as concerns product purity and yield) are obtained at low temperatures. Thus, Perkins[11] recommended operation at 15-30 C until crystallization of product becomes significant, whereupon the temperature is raised.

For reasons of practically feasible reaction time, higher temperature (50-70 C) is called for in plant practice. Within this range, much is gained in product quality by low-temperature operation. A problem arises, however, as the product crystallizes from the reaction mass and this difficulty can be side-stepped in batch operation by raising the temperature toward the end of the reaction period. Similarly, multi-stage processes permit operation at successively increasing temperature (e.g. 50 C in the first reactor, 62 C in the second). Crystallization is also suppressed or at least deferred by employment of high phenol:acetone ratios.

The interrelationship between residence time and catalyst, promoter, and temperature has been noted above. By use of suitable catalyst and promoter (notably HCl and methyl mercaptan), full conversion can be achieved in about thirty minutes—a far cry from the 15 to 20 hours which were required in earlier batch-type processes.

Various purification schemes for product bisphenol-A have been reported, including crystallization, extraction, and vacuum distillation. Actually, Forni[12] has shown that phenol and bisphenol-A will co-crystallize as an intermolecular compound in a molecular ratio of approximately unity. Accordingly, even where crystallization is employed, final purification must employ distillation.

A more direct approach involves the direct fractionation of the crude product received from the reactors. A primary column serves for overhead removal of water, hydrogen chloride, and methyl mercaptan. This is followed by removal of phenol. The heavy material is steam-stripped to remove residual traces of phenol. The bottoms product is taken directly to a flaker.

Direct fractionation of crude product is the basis of the continuous bisphenol-A process illustrated in Fig. 1.[10] This flowsheet shows a continuous dual-stage manufacturing scheme. Typical operating conditions are phenol:acetone ratio of 20:1 in each stage (10:1 overall ratio), 50 C in the first reactor and 62 C in the second reactor. Contact time in each reactor is fifteen minutes. HCl and methyl mercaptan are employed as catalyst system. Bisphenol-A is reportedly obtained in 96% yield. Product purity is characterized by a melting point of 153.8 C (vs 157 C for the pure compound) and a content of material soluble in paraffinic hydrocarbon of about 3.6 wt-%.

Epichlorohydrin: Synthesis of glycerine epichlorohydrin is effected in three reaction steps. (See Equations 3a, 3b, 3c.)

Chlorination of propylene is carried out non-catalytically in the vapor phase. Key to this allyl chloride synthesis is the use of sufficiently high temperature to favor substitution over addition chlorination (the latter reaction would lead to propylene dichloride). Aside from reaction temperature, the chief process variables are chlorine:propylene ratio (which is critical), residence time and pressure.

In the commercial plant, reaction temperature is held between 500 and 530 C. This is the optimum range. At lower temperatures, addition chlorination makes inroads into allyl chloride yield, whereas higher temperatures lead to excessive carbon formation.

Useful yield increases with rising propylene:chlorine feed ratio. A high concentration of chlorine favors yield-consuming chlorination of the desired product. Thus, Williams[13] reports that increase in propylene-chlorine ratio from 3 to 5 raised allyl chloride yield from 66 to 80% in a linear relationship. High ratios are, of course, accompanied by reduced throughput and by increased load on the recovery system, as a larger amount of excess propylene must be handled and recycled. Economic considerations set the upper limit to reactants' ratio at about 5.0 to 5.5.

The method of mixing reactants at the reactor entrance is critical since initial reaction velocity is very high and local overconcentration of chlorine at the mix point can be bery harmful. Use of highly efficient mixing jets is essential in any event. The reactor design itself exerts influence on mixing efficiency. The chlorination has been carried out effectively in converters which consist essentially of empty steel tubes set into a shell.

More recently, van Dijk[14] et al. have claimed improvement of about 3% in allyl yield by using a spherical reactor into which feed gases are introduced at various points through tangentially directed nozzles. Even greater improvement (up to 86% allyl chloride yield at 3:1 reactants' ratio) is reported when several such reactors are operated in series with regard to propylene and chlorination products, and in parallel with regard to chlorine feed.

The desired temperature control is achieved by introducing cold chlorine and propylene at 400 C. Reaction occurs immediately upon mixing and raises the system temperature to 500-530 C (at reactants' ratio of 1:5). Chlorine consumption is essentially complete.

Neither residence time nor pressure are very critical in allyl chloride synthesis. About 1.5 seconds and slightly superatmospheric pressure (10-15 psig) are representative.

The converter make is cooled to 50 C and fed to a pre-fractionator column for the separation of HCl and propylene from higher-boiling components. Its tower top is operated at —40 C. HCl is recovered from the overhead. Allyl chloride is recovered from the pre-fractionator tower's bottoms liquor by fractionation in a series of columns.

Conversion of allyl chloride to glycerol dichlorohydrin (Equation 3b) is carried out in the presence of aqueous phase. Chlorine and allyl chloride may be introduced simultaneously or chlorine may be fed to the process phase at a point downstream of the allyl chloride charge point. In either event, it is necessary to provide very thorough dispersion of allyl chloride through the aqueous phase (solubility at

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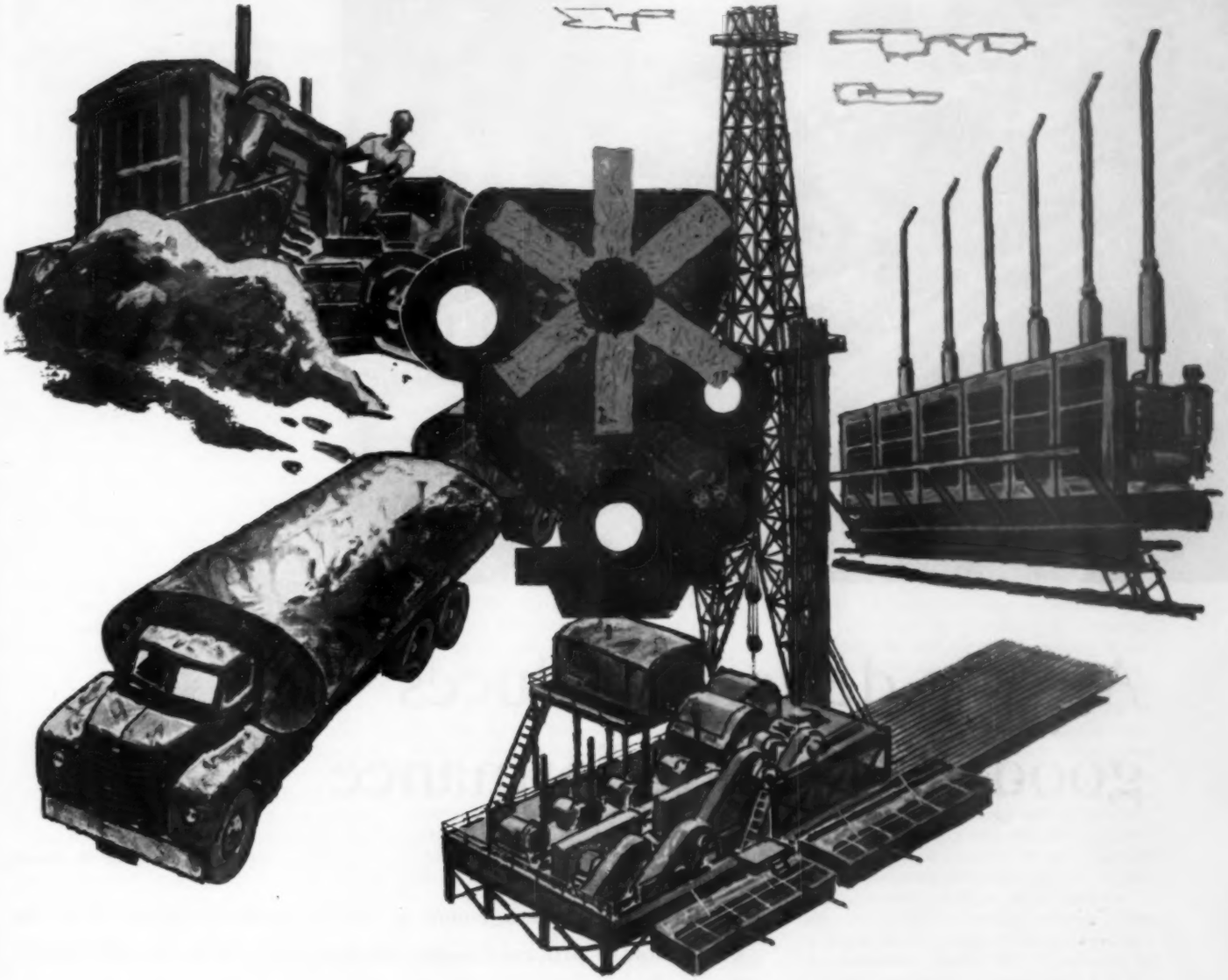

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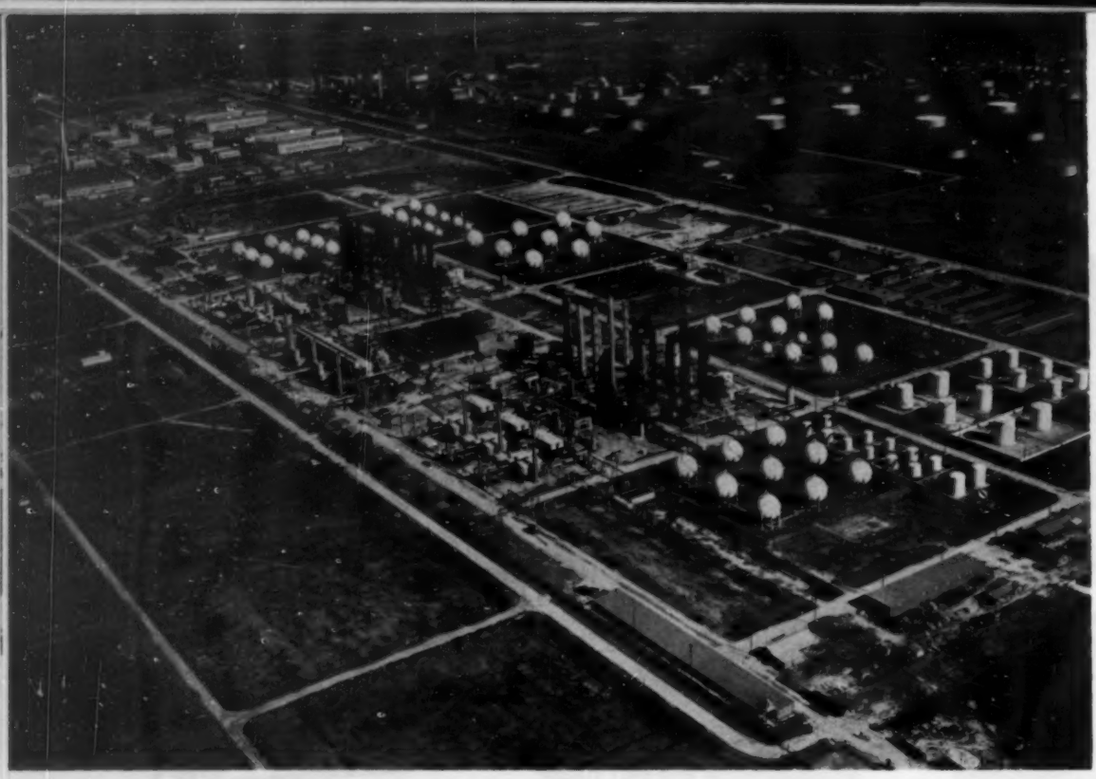


This petrochemical facility, the largest single butadiene plant ever built, is a prime example of artistic design applied throughout a complete processing installation.

Artistic design produces good process performance

by Wheaton W. Kraft

It will pay top management to use the aesthetic approach in the evaluation of process design—in complete plants, in individual processing units, and in each piece of process equipment.

Wheaton W. Kraft, vice president, The Lummus Co., has been associated with the company for more than 30 years. He joined its predecessor, Walter E. Lummus Co. of Boston, in June, 1929, and continued with The Lummus Co. from its origin in 1930, becoming chief process engineer in 1935, and moving to his present position in 1949.

Mr. Kraft holds a B.S. in Chemistry from the University of California in 1924 and an M.S. in Chemical Engineering Practice from the Massachusetts Institute of Technology in 1929. He is a specialist in the fields of distillation, heat transfer, and fluidized solids systems. He holds 29 patents on chemical and petroleum processes and equipment, and has authored seven papers.

An active participating member of the AIChE since 1935, Mr. Kraft is also a member of the American Petroleum Institute, American Chemical Society, Alpha Chi Sigma, and the Chemists' Club of New York. He is a licensed professional engineer (New York).

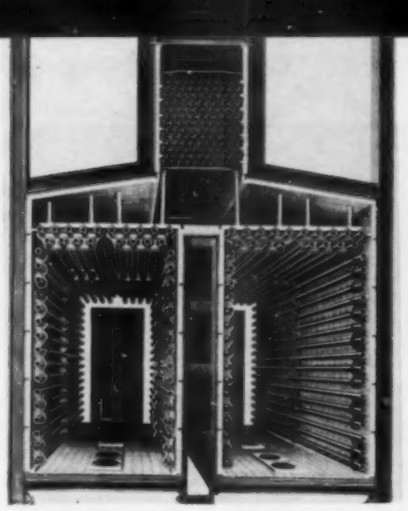


Fig. 1—Geometric forms in a Lummus-designed box heater.

IN THE PRACTICE of chemical engineering, particularly where the design of equipment items and the combination of such items to form a process unit has been fairly well completed, it is most useful to evaluate such designs through the aesthetic approach. The definition of this term is to make such a review by judging the equipment or combinations on the basis of artistic or geometric attractiveness. In other words, a design that looks good is much more likely to perform well than one that looks awkward. An evaluation of this character requires considerable experience to be successful but it certainly is desirable and in some cases necessary.

The evolution of a design starts with simple geometrical elements such as a line, a curve, a circle, a triangle, a square; progresses to more complex forms such as a sphere, a cylinder, a pyramid and a parallelogram; then to combinations such as an arch, a truss, a slab, a coil, a cylindrical vessel with curved heads, etc.

Consider the elements of a typical process unit in normal sequence, starting with a charge pump or compressor. The heavy reciprocating machines involving massive foundations, multiplicity of units and all the design problems inherent in stop and go action such as surges in pressure, vibration and means of control have today been largely replaced by centrifugal pumps and, more recently, high speed gas turbines and multistage centrifugal compressors. This modern machinery is literally a work of art with its streamlined passages, vanes, clearances, seals, controls and all of the elements which go to make an artistic yet commercially acceptable design with good flexibility and dependable performance.

An important element of the typical process unit is the heater. Here we find several geometric forms, providing flexibility and capacity in varying degrees. Most common form is the box which provides combustion volume and walls for disposition of tubular surface in the form of coils made up of straight tubes joined together by 180° bends and supported at suitable intervals. (See Fig. 1.) The dimensions of the box are varied to suit the process heating requirements, but, in general, the length of tubes employed dictate the length, the ability to produce a uniform heat source provided by radiating hot gases and radiating refractory walls determines width and height. Within such limits, the most economical design would have a height-width ratio greater than 1.0 and would discharge flue gases upwards.

Burners could be located in the end walls or the heater floor. The first arrangement is cheaper because the heater need not be elevated, but the latter provides much more uniform heat release within the combustion chamber because of an improved pattern of burner location. In addition, the floor installation allows the use of burners of short flame type which can be much more easily adjusted for efficient combustion than the long flame type which would have to be used where burners are in the end walls, largely due to normal combustion chamber dimensions.

One widely accepted modification of the basic fired box is the use of multiple combustion chambers within a common heater setting providing a combined flue gas stream with independent control of the heating requirement of several process streams. A major improvement in efficiency of heat absorption and utilization of tube surface is obtained by the use of specially designed refractory tiles covering the roof tubes of the Lummus patented heater. (See Fig. 2.) The overall tile pattern produces just enough back pressure to force uniform release of hot gases over the entire roof area into the plenum chamber above. However, each gas passage is streamlined to provide a high-velocity gas stream across the upper half of the tube surface for a substantial increase in the heat absorption rate for this area of the tubes by increased convection heat transfer. This is certainly an example of an artistic approach to improved efficiency.

Another widely used heater design is the vertical cylindrical heater, probably the least expensive design because of its simplicity. A cylindrical steel shell lined with refractory brick provides the combustion volume. The radiant tube surface is disposed against the wall in the form of coils with the weight supported from the top, providing free expansion downwards and greatly simplifying the support problem. Burners are normally installed in the floor so that with the flue gas stack mounted above, the furnace itself provides part of the draft needed.

Other heater types also have modified geometrical formation. One is the so-called A-frame heater which has a triangular cross section radiant chamber surmounted by a rectangular cross section for convection tube surface with the stack mounted above. Another type uses a tall narrow chamber with the coils supported in the center and burners in the side walls on a distributed pattern. This design also employs a convection section above the radiant chamber with the stack on top.

The design of piping systems is an area in which the artistic approach becomes almost an engineering necessity. This is an area of concern for flow of all fluids—gases, liquids, gas-liquid combinations, solids, solid-liquid combinations such as slurries, dilute phase solids-gas systems such as transport

Fig. 2—Roof tile design in the box heater provides streamlined hot gas flow and increased convection heat transfer.

lines, dense phase systems such as fluidized beds, standpipes and transport lines. Here are all the pitfalls of the non-artistic design: erosion, plugging, high pressure drop, vibration, cavitation and all the other bad words that mean high operating cost and high maintenance—even, in some cases, nonperformance.

In the case of single-phase, relatively constant volume fluid flow, design problems are not severe. However, in the case of two-phase, gas-liquid flow, either with increasing volume of the mixture as in a heating operation or with decreasing volume of the mixture as in condensing or cooling, the design approach must be carefully calculated and evaluated. For example, application of heat to a crude oil charge stream will eventually create a vapor phase at some given combination of temperature and pressure, particularly if an aqueous phase exists at the same time, either as a suspension or an emulsion. Once vapor exists, the uniform division of the fluid into two or more parallel streams becomes extremely difficult, in part due to control problems and in part due to the effect of symmetrical or non-symmetrical geometry in the parallel circuits. The effects are noticeable where crude is preheated by exchange against hot process streams. As the crude oil streams subsequently pass through the fired heater, the volume expands substantially and the necessity for further subdivision is apparent.

This is one of the key areas in which the artistic approach can be most useful. Although it is preferable generally to increase cross-section in multiples of two; velocity effects and the sudden expansion at each transition point require careful design of such points to insure a relatively uniform split of the total vapor-liquid mixture, without uneven segregation of vapor and liquid. This problem is accentuated where vacuum distillation facilities are downstream from the heater. To increase vaporization within the heater proper and eliminate excessive temperatures within the heated zone, common practice is to use a large number of parallel tube passes near the outlet, which then normally discharge into rather large diameter lines for transferring this two-phase material to separation facilities.

Here again is a problem of optimum transition design. In one example, a simple study of the geometry of the system quickly showed that this had been overlooked in the calculations. Inadequate provision for

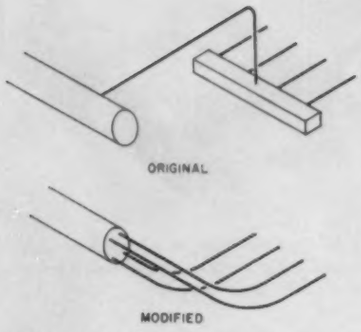


Fig. 3—Modified—and more artistic—approach to heater outlet design increased the maximum temperature attainable in the heater.

streamlining the discharge from a multiple tube arrangement to a single large transfer line would result in unusual turbulence, restriction of flow pasages and excessive pressure drop. Additional calculations checked this conclusion. As a result, a modified streamlined design and new calculations were prepared to show the difference in the maximum temperature within the heater for the two arrangements. Without the change to the streamlined arrangement, a maximum temperature of 30 to 40 F higher would have been obtained for the original design. Because the maximum temperature was critical in that it approached the temperature at which thermal decomposition would take place, the modification was a necessity. In actual operation, the revised streamlined design proved to have none of the weaknesses of the original design and the final calculations were confirmed by test data. The basic elements of the original design and the modified design are shown in Fig. 3.

To those familiar with the art of moving bed catalytic cracking, the elements of an artistic approach to insure uniform distribution are well known. In fact, the entire key to successful operation of such units is uniformity—including uniformity in catalyst particle size, catalyst distribution to reactor and regenerator, distribution of vapor, liquid or mixed feed to the catalyst, and catalyst withdrawal over the cross section of reactor and regenerator. When these principles are adhered to, the complete reactor and regenerator systems are efficiently utilized, with uniform carbon deposition and uniform carbon combustion.

The artistic approach is necessary also in dense phase solids-gas systems such as fluidized beds, standpipes and dense phase transport lines. Without it, gas channeling can occur, with extremely severe erosion. Solids may settle with resultant non-uniform fluidization or actual physical blockage leading to very poor contact efficiency and, in some instances, to poor performance and even non-performance. These detrimental effects can be due to lack of adequate or uniform aeration, to false assumptions in determining submerged angles of repose and to other geometrical factors of similar nature.

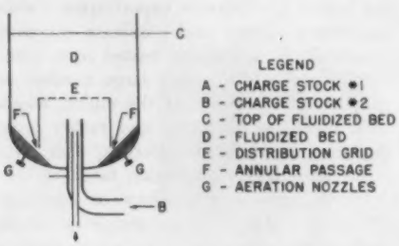


Fig. 4—In a fluidized bed reactor, greater attention to art in design reduced settling of catalyst, as shown above.

Fig. 4 shows a fluidized bed reactor in which such a phenomenon took place. The two feed streams flowed through the bottom of the vessel in concentric piping so that they first mixed in that portion of the bed bounded by the distribution grid and an inner cylinder extending from the outside edge of the grid downward. It was thought that substantial circulation from the main portion of the bed above the grid would take place downward through the annular space and thence upward to provide very rapid mixing of the reactants and the catalyst. In actual operation, catalyst flow downward through the annulus did not maintain aeration and fluidity, and the catalyst began to settle as shown in the shaded area, until a submerged angle of repose had been reached.

The significance of this can be seen by the very marked constriction between settled catalyst and the bottom edge of the internal cylinder. As a result, the intimate mixing and rapid establishment of uniform temperature expected just below the grid were not obtained.

A relatively simple modification made the original design concept possible: (1) cutting off a part of the internal cylinder to increase clearance between its bottom edge and the bottom head of the vessel, and (2) providing distributed aeration to the zone where settling had taken place.

One more system should be mentioned, the normal condensing system where very large volumes of vapor are cooled and condensed with substantial reduction in volume. Here, the design approach calls for symmetry in both the piping and the condensing surface, particularly where large multiple units of shell-and-tube construction are used. The design of the tube bundles, the baffling and the location of connecting nozzles must reflect the requirements of the system. In the case of substantial uncondensed vapor volume at the exit, the two phases shall be kept as well mixed as possible throughout the circuit to insure the maximum "sponge" effect of the heavier condensate in assisting condensation of the lighter components and to approach a true equilibrium exit temperature. Any appreciable vapor or liquid by-passing due to poor design will obviously prevent these objectives from being reached. A good example of symmetrical arrangement is shown by Fig. 5.

The next area benefited by an artistic approach is the reaction or separating vessel. The usual shape for mechanical and economic reasons is a cylinder with dished or hemispherical heads. In some recent designs, a sphere has been used. A reactor will contain an entrance zone, a catalyst bed, or beds, and an exit zone. The design must achieve uniform distribution of entering material without disturbing the catalyst bed surface, uniform flow and pressure drop through the bed, a bed support which will not create substantial pressure drop, and an exit zone which will allow phase separation if desired, and avoid channeling of fluid flow through the bed.

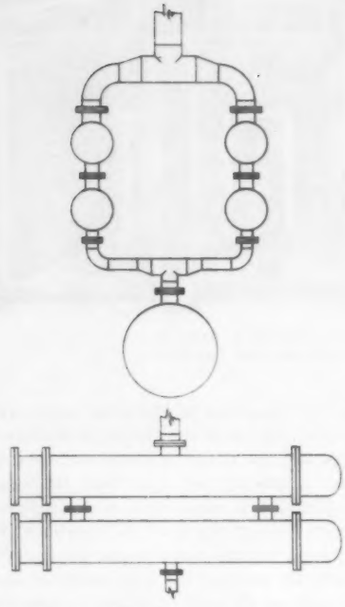
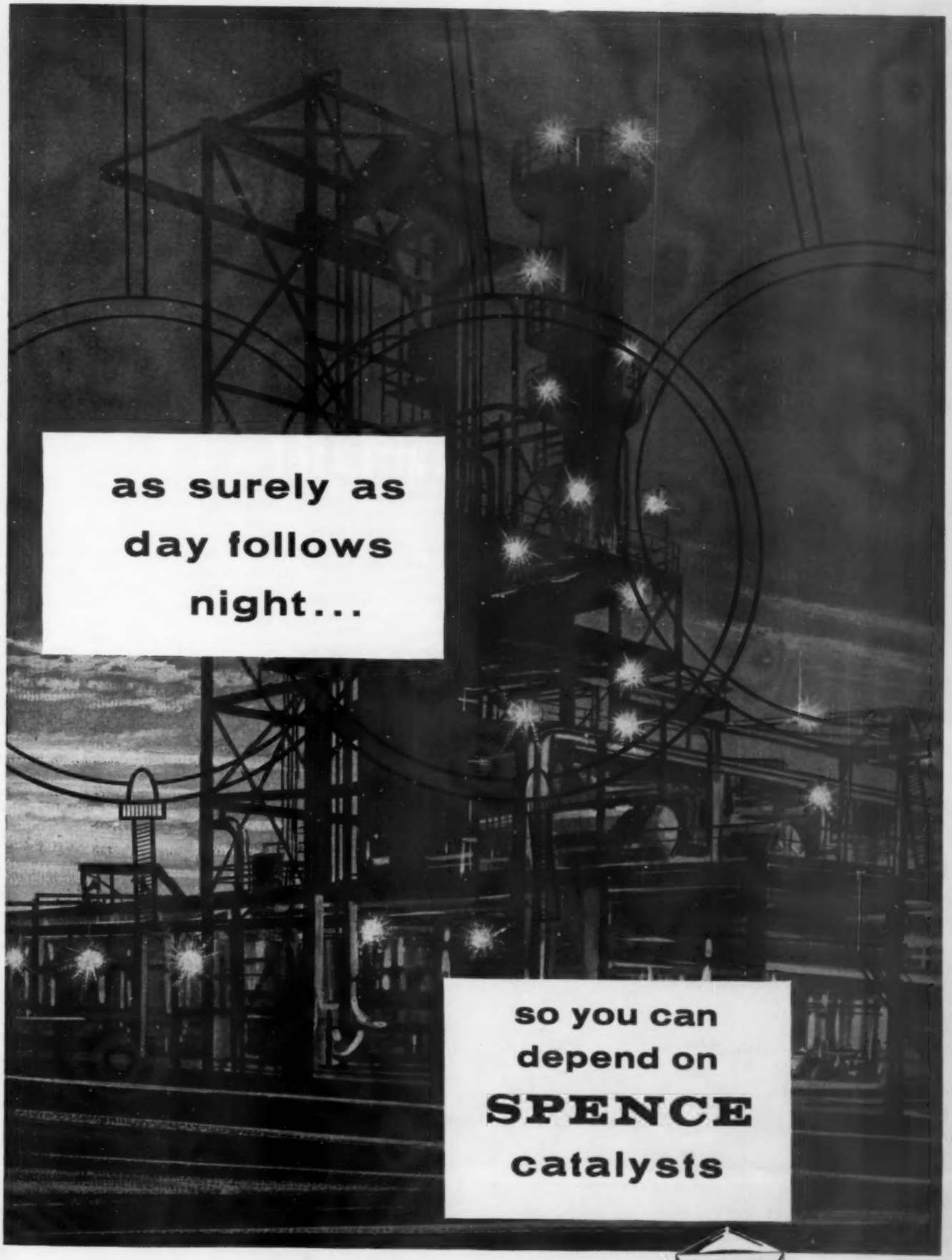


Fig. 5—Symmetrical design is easily recognizable in this condensing system arrangement.

Geometry helps to reach these objectives. The normal catalyst shape, a cylinder or sphere, provides a predictable pattern for packing the bed to a uniform density and also provides passages for uniform fluid flow with predictable contact efficiency and uniform pressure drop. Some years ago, the common support means was a metal grid with a high-percentage opening, upon which a layer of large non-catalytic ceramic spheres was placed, followed by layers of successively smaller ceramic spheres, down to a size which would retain the catalyst bed itself without excessive penetration of the support layers by the catalyst during operation.

The major weakness of this early design was the use of the metal grid. The very high cost of alloy material needed to meet increasingly difficult operating conditions limited the choice of metals. As a result the original design was modified, eliminating the metal grid by simply filling the bottom head of the reactor with the same series of layers of ceramic spheres and providing a means for uniform product withdrawal in this zone (Fig. 6).

A key element of any process unit is the separator or fractionating tower. Here again the same geometric shape as for reactor vessels is used, the cylinder and occasionally the sphere. However, different considerations dictate the design approach for fractionator internals. The prime requisites are: (1) a heat supply to provide a vapor or



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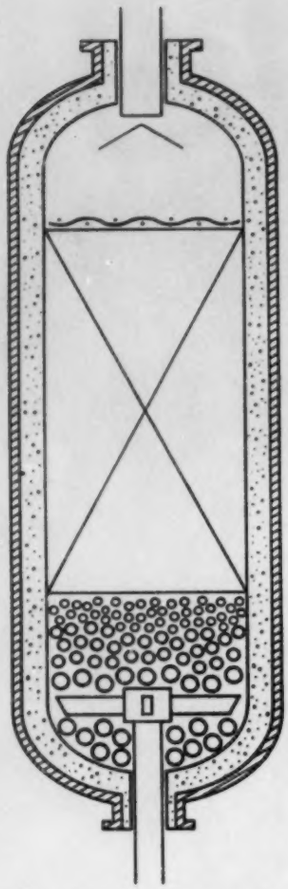

Fig. 6—The geometry in successively larger ceramic spheres at the bottom of typical reaction vessel eliminated need for metal support.

vapor-liquid feed at the bottom of the fractionator, (2) a heat removal system with means for return of the condensed lowest boiling material at the top, and (3) a series of vapor-liquid contact devices distributed throughout the vessel.

The inventive nature of man has created numerous types of contact devices to meet the changing needs of the fractionation system as regards operating temperatures and pressures, differences in vapor to liquid ratio, the complexity of the mixture being separated, the possibility of thermal decomposition or polymer formation and even, in some cases, the presence of two immiscible liquid phases.

One of the earliest designs employed was the disc and doughnut pattern shown in Fig. 7. The geometric forms used are compatible with the circular cross section of the vessel. Also shown are modifications of the simple basic design, one a flat cone instead of a disc, the other an inverted truncated cone. The final modification was a perforated ring just upstream of the edge of the disc or the doughnut elements, with further subdivision of the flow in the form of a shower, and still further improvement in contact efficiency. This was the original form of the so-called "shower tray."

Even today, after many years of evolution, these types of contact devices find a useful place in process design. A very similar form of the same device shown in Fig. 7 is an arrangement with the plates side-to-side, or alternately, a central plate with two corresponding side plates. This has been preferred to the disc and doughnut in some instances for simplifying the mechanical design and support requirements.

Another very early design was the perforated tray. Downpipes were to carry liquid from one tray to the next below and the liquid flow was across the tray from one side to the other. There have been several periods when the perforated tray was favored then not favored, until today when it is again returning to favor though in different form, and with a considerable increase in knowledge of its operating characteristics.

Two things have contributed to this recent trend. One is the great amount of work and information acquired by the Shell group in developing and evaluating the "Turbogrid Tray," a perforated tray with rectangular instead of circular openings. The other very strong influence has been the work of Fractionation Research, Inc. in studying this type of tray as well as many others. F.R.I. also coined a term for a perforated tray with no downflow pipes, referring to this as the "Dualflow Tray" because descending liquid and rising vapors must both pass through the same openings in opposite directions in cyclic flow of high frequency. The Dualflow Tray is unique in suitable applications in that it employs almost the entire cross section of the fractionator vessel for vapor-liquid contact. Worth mentioning also are several types of proprietary valve trays which are, in effect, adaptations of the perforated tray but using some form of weighted plate over the openings and a restraining device to keep such plates from rising past a predetermined level. The annular opening created during operation automatically enlarges as vapor flow increases or diminishes as vapor flow decreases. Such trays have been particularly favored and performed well where variable loadings are expected.

Undoubtedly, the most widely used fractionating tray design is the one using bubble caps. All such trays have the same basic assembly including a vapor chimney covered by a cap held down so that all working areas are fixed for each cap assembly. There have been so many different types used that it is difficult to list them all. However, looking at a bubble cap in plan view, the geometrical shapes used have been triangles, circles, hexagons, rectangles of varying width-length ratio, diamond shapes, star shapes and possibly others. Most of these caps employed circular risers, but in some instances the riser geometry has matched the cap geometry, particularly in the case of long rectangular caps. Other features which vary considerably are the use of open or closed slots, straight or sloping skirts, rectangular or triangular slot openings and clearance of the slots from the tray level. The favorite would undoubtedly be the circular cap which is in the form of a cylinder with a rounded top and with triangular slots at the bottom edge of the cylinder.

Spacing of assemblies on the tray plate is usually controlled by requirements of liquid flow. In the earliest designs, one common practice was to have radial liquid flow from the center to the outside of the tray for one tray and from the outside to the center for the trays above and below, the location of downflow pipes giving this pattern the title of "rim and center." This tray design is shown in Fig. 8.

As the technology of fractionation improved, the trend was to much larger tower diameters and much higher pressures. Tray design had to be modified to match these

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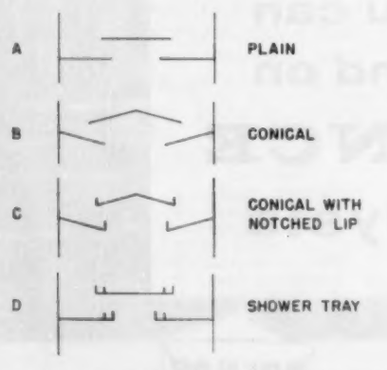

Fig. 7—Familiar variations of the disk-and-doughnut pattern for fractionating trays.

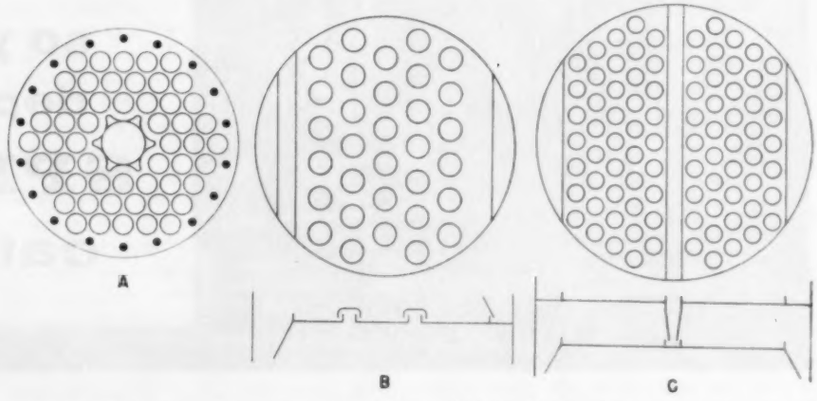

Fig. 8—Several forms of perforated trays. At A is the rim-and-center pattern; at B is the single cross flow tray, and at C is the double cross flow tray.

Foster Wheeler, Hygrotherm Engineering, Kestner Evaporator and Rose, Downs and Thompson recommend

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ICI

Taiwanese coolies excavate for refinery construction on Formosa.

Desert transportation is a singular contrast to that in U. S. (Fluor photo.)

Getting on target with overseas estimates

by William I. McKay

Developing and predicting the cost of a process plant construction project outside of your own familiar country can create obstacles, says Mr. McKay, who suggests ways in which such problems can be overcome

THE ACCENT on expansion in the petroleum industry has been concentrated outside of USA within the past five years. This trend will not only continue but will also grow in importance as the economies of other nations continue to thrive in a development climate. With the establishment of each new beachhead, a myriad of fresh problems will confront owners, budgeteers, engineers, contractors and estimators.

Following World War II, petroleum men customarily tossed off such vague statements as "twice U.S. cost" or "three times U.S. material cost" when they took time out from the mushrooming domestic refinery expansion to occasionally consider overseas projects. Anyone in the industry who used the phrases "fixed price" or "lump sum" in a discussion of overseas project contracts would have been considered balmy.

As more and more overseas projects developed and as international economies strengthened, the competitive situation inexorably developed. It is important today to accurately determine the capital cost requirements for a given overseas expansion, and, as succeeding ventures become more marginal, this will grow in importance.

To say that it is a simple chore to evaluate domestic projects is ridiculous, in fact, downright naive! It takes years of experience, lots of accurate cost data and plenty of midnight oil to prepare a realistic estimate. However, estimating domestic work is relatively simple compared to the task of accurately estimating capital costs for overseas projects.

The Stateside engineer takes a host of facilities and services for granted when planning a domestic plant. He doesn't need to check these things; he knows that they are there and available. This engineer probably doesn't question the availability of goods and services. He assumes without a worry that electric power, potable water, communication systems, roads, railroads, skilled labor, construction equipment and the many materials required will all be available as rapidly as they can be engineered or utilized. Nor does this engineer have a currency problem, or import duties, or a language barrier. He does have plenty of problems, but they are mostly technical.

On overseas projects, availability is the key to many of the problems that arise. We can consider these problems in three major areas: materials, labor and services.

First, you should find out what materials can be supplied by the specific country within which the project is located. To assess this, you need to know the cost, quality and delivery data on these materials. This is tricky—particularly for quality and delivery. It means inspecting shops, mills, raw materials supply and finished products. To be truly "available," material must be ready when required. Suppliers' capacities and backlogs of orders should be known. A mistake in judgment here might add many months on the completion date of the project.

Due to quality or delivery requirements, you might wish to import certain materials rather than use locally-obtainable materials. Generally, this will require considerable manipulation before approval can be obtained.

Second is the matter of duties and taxes. Often, preferential duties will be in effect. Normally, these items are covered by written rules, copies of which are readily obtainable. This data will help you locate the

most favorable material market for the imported materials.

Third, you have to determine how to get this material to the jobsite. This means investigating harbors, docks, heavy lift equipment, railroads, roads, bridges and other possible barriers. Such an investigation is an important step, for it will set the ground rules on maximum weights and dimensions that can be handled.

Finally, costs have to be determined for export boxing, brokerage, ocean freight, inland frieght and insurance. Heavy lift and extra length charges also have to be considered with the freight.

In general, the results of these investigations provide the basis upon which a material estimate and a material delivery schedule can be prepared.

Availability of Labor. As with materials, you must determine what labor skills and what quantity of skilled labor exist in the area of the project. A good starting point is to get a history of any previous similar work, then to find out if it was done by local labor or local subcontractors. Finally, you should determine how long it took to construct. You can ascertain from this history which particular crafts are skilled and how much imported labor and supervision might be required.

Next, you get copies of any labor laws and regulations that might exist. You find out on what basis expatriate labor can be imported, and you determine any wage rates and benefits which are in effect. Again, past history can be a big help in determining benefits, hours per week worked and holidays and fiestas.

Now, let's take a look at subcontractors and subcontract prices. In certain cases, it may be politic to subcontract a great amount of the field labor. Elsewhere, this policy would hinder the project. To assess the subcontractor, you must look at and inspect his completed work, his construction equipment, his manpower or work force, and, discreetly, his financial position and standing in the community. Any unit cost information that can be obtained from subcontractors will be of considerable help when assessing labor productivity.

Labor productivity is a tough one. It is a function of many things: climate, local practices, know-how, amount of expatriate supervision, construction equipment, construction methods, training programs and economic and political factors. It is virtually impossible to assess labor productivity without previous experience in comparable situations. Of course, no two situations are the same, but past experience here is the big thing. Generally, the less the economic development, the lower the hourly wage rate and the productivity. Again, any past history here on similar work is an excellent clue.

The general state of employment in the area is closely allied to labor productivity. Again, this provides a helpful clue.

Availability Of Services is easy—this can be seen. First, you look at utilities. Is electric power available? If so, what voltage and frequency? How much power is available? What about interruption? Then, where is the water supply? How much? And what about telephone service? What kind of transportation is available? How much does it cost, and how often does it operate? How much fire protection? Is it available, or must you provide your own? Is guard service required, and is it available?

Next, the availability of construction equipment has to be investigated. Again, you must consider what is available, how much it costs, what kind of shape it is in with respect to repair and condition, and when it will be available. If you decide to import some or all of this equipment, you must determine if it can be brought in duty free and if it can be sold or removed after the project has been completed.

Finally, where is the field work force going to live? Local housing, medical, commissary, community and recreation facilities have to be assessed. Will a camp be required? For the entire work force or just the expatriate force? What will a camp cost? These questions require good answers, for they have a big effect on project cost.

So much for availability. Now, you should consider several other items before you can complete your basis for an estimate. Listing these, you put site questions at the top, then currency, language, cost of living, local laws or codes of business, and, finally, personal income taxes. Let's analyze these items individually.

Site Information. Most of the questions here are ones you would ask about a domestic site. You will need soil data, drainage features, terrain, accessibility by rail, by road and by water, and the exact location of material supply sources, ports of entry and towns.

Meterorological data should be collected from all available sources. You need such data to determine your construction schedule, and they may well have a bearing on local productivity.

Are there any local codes, laws or regulations which will affect the project, and will local bodies make frequent and costly inspections?

Also, you should look at waste disposal. This is most important because local opposition can be a great deterrent to the progress of the work. A suitable waste disposal system must be designed to suit local conditions and requirements.

General Considerations. Currency can be a problem. Often, there are two rates: an official rate and a trading rate. These two rates can be significantly different. Generally, it is most expedient when building the estimate to keep all moneys in equivalent dollars and not to use local currencies at all in the estimate.

Language barriers can be troublesome. Every effort should be made to hire expatriates who speak the local language. But this is often impractical, and local interpreters must be used. Obviously, communication with the work force can have a substantial effect on labor productivity as well as public relations.

About the author

William I. McKay is manager of the estimating department of The Fluor Corp. Ltd., Los Angeles, Calif. He won a physics degree at San Francisco State College and a graduate degree in meteorology at Massachusetts Institute of Technology. McKay was previously a chief estimator for Refinery Engineering Co., Tulsa, and supervising estimator for Bechtel Corp., San Francisco. He is a registered professional engineer in California.

Some kind of bench mark has to be placed on the cost of living for the expatriate work force so that equitable compensation can be established. Often the easiest place to get reliable information is from other expatriates already living there and from the U.S. Consulate.

The effect of local laws pertaining to business as well as to income taxes for business and personal income has to be investigated. Again, expatriates and the Consulate are of great help here. For more precise information, a local attorney is the solution to this problem.

From the results of this survey, you can proceed with the estimate in a logical manner. Of course, the project must be tailored to suit the utilization of local materials and to allow for local climate. Also, in areas where operating labor is of very low cost, pay-out on maintenance features will become marginal or non-existent.

As all of the many variables and individual problems are pinned down, more and more confidence can be placed in the estimate. Accordingly, much international business today is now handled with some kind of fixed-price arrangement.

This is not a path that can be safely trod by the unwary or the very young. There is no substitute for past experience tempered with sound judgment.

Obviously, the most uncertain of all the variables is centered around labor productivity. There is one salient feature here, though, for in areas where little know-how and previous experience exists, there is also a very low man-hour cost.

To get on target, you need a guidance system. This outline can be your guidance system, but it still takes plenty of common sense and hard work—liberally mixed with past experience—to produce accurate overseas estimates. END

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WOODCHESTER, STROUD, GLOS., ENGLAND.

by William C. Uhl
Processing Editor

Highlights of the month—reviews of recent reports on refinery waste disposal techniques: reducing phenol in plant effluent to a level of 15 parts per billion; use of air flotation to improve treatment efficiency

Because many of the world's refineries are located in or near large populous centers, refinery management must continue to pay increasing attention to problems of waste disposal. Besides being faced with legislation that requires close control of potential pollution, management is finding that it is simply good public relations and good business to carry out strong measures to prevent stream and waterway pollution.

Cities Service Oil Co. Ltd., for example, found that an expenditure of some $3 million on pollution control at its new 20,000 b/d refinery at Trafalgar, Ontario, completed in May, 1959, does indeed show a payout.

The company decided to install facilities which would produce a refinery effluent to meet all requirements of the Ontario Water Resources Commission. Among the stringent requirements was a standard calling for phenol content not to exceed 15 parts per billion. This meant a cost of $1.5 million just to bring phenol from the 0.5 part per million level down to the standard.

The waste treatment plant installed is fairly conventional, though it did have some unique features. Among these was the housing of all process units, primarily to facilitate temperature control of the biological treatment unit but also to improve operator supervision. Another feature was in the use of a new material called "Dowpac," as a tickling filter medium. Because of its special configuration, Dowpac permits use of filters up to 20 ft in depth, thus greatly reducing the surface area required. It also has no tendency for mechanical plugging. In addition to the biological oxidation unit, the company uses chemical oxidation —through ozonation—of the residual phenols, to assist in getting down to the 15 ppb level.

The payout has been achieved by dramatizing to the general public the anti-pollution measures provided at the plant. Inasmuch as the company now has facilities which turn out water essentially fit for human consumption, it installed an atractive aquarium and stocked it with various fish common to the Great Lakes area. This aquarium is readily accessible to the public and outsiders are invited continuously to visit it and see fish swimming in the refinery effluent. Besides the aquarium proper, visitors inspect the waste treatment plant, its laboratory, and enjoy a landscaped fountain display—operating on refinery effluent.

The good response given this demonstration has been most gratifying, company officials report, and Cities Service attention to the very important public problem of clean water and water conservation generally is now being carried forth in its product and institutional advertising in Canada with considerable success.

A new waste water treating plant being built by Atlantic Refining Co. for part of its Philadelphia refinery will include air flotation as one of the techniques as a result of success with pilot studies of this method.

Two-stage treatment will be used because the complex waste from the refinery includes raw sanitary sewage. The first stage consists of a covered preskimmer to reduce vapor losses and a standard API oil separator. The second stage involves chemical flocculation, controlled neutralization and air flotation. These facilities are expected to remove 97% of the oil, 75% of the suspended solids, and to reduce both the chemical and biochemical oxygen demands by 80%. Storm water as well as dry weather flow will be handled without the use of an impounding basin.

Air flotation consists of dissolving air under a pressure of 30 to 40 psig in the waste water. When this pressure is released, extremely fine air bubbles are formed, which become attached to suspended matter in the water (solids and oil) and rise as a scum to the water surface. Laboratory and pilot studies were conducted on the many variables affecting flotation efficiency.

Among the advantages of this process are: (1) the rapid rise rate of suspended matter, thus keeping holdup time to a minimum, (2) the ability to handle shock loading of oil, flow, and temperature changes, and (3) the inherent advantage of preoxygenation of waste water before it is discharged into a stream.

What's New in Processing Plants

Phillips Petroleum Co. has made a firm application to build a 5,000 b/d refinery at Alajuela, Costa Rica, at a cost of about $10 million. The operator is to be a joint stock company with half Costa Rican capital.

• • •

The CATC Group has completed a $1.3 million absorption type gasoline plant at Grand Chenier, La., with initial capacity of 175 mmcf/d of gas, expected to be expanded at a later date. Construction was by Delta Tank Mfg. Co. The CATC Group includes Continental Oil Co. as the operator, and Atlantic Refining Co., Tidewater Oil Co. and Cities Service Co.

• • •

The new 5,000 b/d Newfoundland refinery being built by Golden Eagle Refining Co. Ltd. is located at Holyrood, 30 miles from St. John's, and will process crude oil from Venezuela.

• • •

The Chief Ministers of Madras and Kerala have each advised the Indian government of their support of the plan for establishing a 20,000 b/d state-owned refinery in south India, although each state has rival claims for the specific location. Burmah-Shell has also offered to expand its Bombay refinery by 26,000 b/d with no further expenditure of foreign exchange, but the offer is still under consideration by the government.

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Calvo Sotelo, subsidiary of the Spanish state company INI, plans to refine about 22,000 b/d of Middle East crude oil at a conventional refinery to be built adjacent to its shale oil plant at Puertollano. Annual outputs of over 500,000 tons of fuel oil, over 200,000 tons of gasoline and over 200,000 tons of gas/diesel oils are envisaged, and new petrochemical facilities are also planned. A new 283 km, 12-in. crude oil pipeline from the Mediterranean port of Malaga would be necessary.

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Continental Oil Co. has completed a new $560,000 package-type natural gasoline plant in the El Mar field of New Mexico, 20 miles west of Jal, with an initial capacity of 5 mmcf/d of gas, and has added stabilizing and processing equipment to its 5 mmcf/d plant at Ramsey, near Pecos, Tex.

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Deutsche Shell's new 4 million ton/yr refinery at Godorf, near Cologne, was officially opened in mid-July by Prof. Siegfriede Blake, Federal Minister for atomic energy.

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Czechoslovakia has signed an agreement with the United Arab Republic to build a 20,000 b/d refinery in Suez.

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The South Korean government has started an entirely new program for constructing a 15,000 b/d refinery, the announcement officially disqualifying Korean Petroleum Co. as the sponsor of the project originally reported some months ago, before the downfall of President Syngman Rhee.

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DX Sunray Oil Co. will increase capacity of its Tulsa, Okla., refinery to 85,000 b/d with a new still which will replace the five existing crude units with combined capacity of some 75,000 b/d. Completion is expected in 1962.

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Two major gas processing projects are up before the Alberta Oil and Gas Conservation Board for approval, both designed to supply residue gas to Alberta and Southern and Westcoast projects from Alberta to the USA west coast. At Whitecourt, Pan American Petroleum, Hudson's Bay Oil and Gas, and Canadian Fina will enlarge their present 30 mmcf/d pilot operation to 215 mmcf/d facilities, capable of turning out 13,450 b/d of liquid condensate, 1,980 b/d of butane, 1,420 b/d of propane and 620 ton/day of elemental sulfur.

At Calgary, Jefferson Lake Petrochemicals of Canada Ltd. plans a $12 million, 150 mmcf/d plant capable of turning out 2,170 b/d of condensate and 863 ton/day of sulfur. Both projects are planned for completion in 1961.

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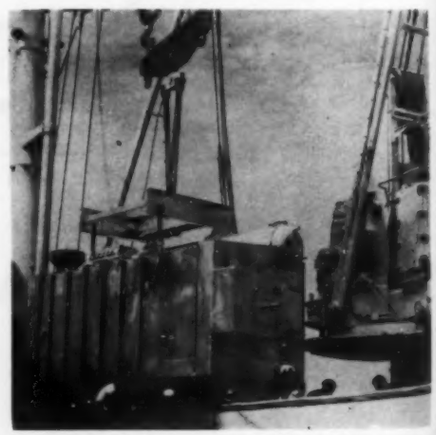
(*Continued on page 92*)



The world's first shop-assembled boiler fired by carbon monoxide is shown here, as the 64-ton unit was lifted aboard the vessel CAP BONAVISTA by two 45-ton gantry cranes at the Wilmington State Docks, Port of Wilmington, North Carolina. Named the "PAC-CO" Boiler by its manufacturer, Babcock & Wilcox Co., it is destined for a refinery in Montevideo, Uruguay.

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WHERE RESEARCH TODAY MEANS PROGRESS TOMORROW

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Ente Nazionale Idrocarburi, the Italian state firm, plans a 120,000 b/d refinery in Bavaria. Suedpetrol A.G., formed by ENI in Munich with a German banking group, has acquired a site in Ingolstadt, and completion is planned in two years.

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Standard-Vacuum has invited tenders for a $30 million, 37,000 b/d refinery to be completed late in 1962 near Adelaide, South Australia.

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An official of the group which is building a new refinery at Schwedt-on-Oder, East Germany, has said initial capacity on completion in 1963 will be about 40,000 b/d, to be increased to 80,000 b/d in 1965, and to 160,000 b/d in 1968.

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The Polish Council of Ministers' Economic Committee has approved preliminary plans for the Plock refinery, to be of some 120,000 b/d capacity, at a total cost of about $100 million, and with completion of a 40,000 b/d crude still by 1964 as the first stage.

• • •

Hydrocarbon Research Inc. has been awarded a contract to engineer and construct an expansion in liquefied propane and butane facilities at the SACOR refinery near Lisbon, Portugal. Completion is set for 1961.

What's New in Petrochemicals

Ashland Oil & Refining Co. has started construction of its new "Hydeal" process plant (licensed by Universal Oil Products Co.) at Ashland, Ky., with completion expected by February, 1961. Designed to produce 75 million lb/yr of naphthalene and several million gal/yr of benzene, the unit is being built by Badger Mfg. Co.

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A new styrene unit, to be completed early in 1961, will raise Shell Chemical Co.'s capacity at Torrance, Calif., to 210 million lb/yr.

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A contract for the largest single sulfuric acid plant in Greece, 376 metric ton/day, has been awarded to Chemical Construction (G.B.) Ltd. of England, a subsidiary of Chemical Construction Corp., New York. Chemico will furnish the design, engineering, equipment, supervision of construction, and initial operation. The plant will be at Ptolemais, and erected for the Greek Ministries of Industry and Coordination as a part of a large nitrogenous fertilizer plant.

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Stauffer Chemical Co. and American Synthetic Rubber Co. have formed a new firm, American Rubber and Chemical Co., which plans a $10 to $15 million plant at Louisville, Ky., to produce poly-butadiene and polyisoprene rubbers, under a licensed process from Phillips Petroleum. Completion of the 30,000 long ton/yr (initial capacity) plant is scheduled for September 1961. Design will be such that output can be raised to 50,000 ton/yr.

• • •

Imperial Chemical Industries will invest about $16 million in Argentina through its South American subsidiary, Duperial, which plans a new polyethylene plant on the outskirts of San Lorenzo.

• • •

Firestone Plastics Co. Division of Firestone Tire and Rubber Co. has awarded a contract to Catalytic Construction Co. for the complete engineering, procurement and construction assistance in the expansion of the polyvinyl chloride resins plant at Pottsown, Penna., with completion planned by early 1961.

• • •

British American Oil Co. will complete a new $2.5 million aromatics extraction unit at Montreal East, Que., by mid-1961. It will be a Udex unit, developed jointly by Universal Oil Products Co. and Dow Chemical Co. Primary product, benzene, will be supplied to the nearby B.A.-Shawinigan plant for cumene production.

• • •

Phillips Chemical Co. has announced an increase of 5,000 long ton/yr in production capacity of its new "Cis-4" polybutadiene rubber plant at Borger, Texas, with completion in the fourth quarter of this year.

• • •

Border Chemical Co. has put onstream its new 75 ton/day, $1 million, sulfuric acid plant at Winnipeg, Manitoba, marking that province's first entry into the basic chemical field. Raw material is reportedly coming from Alberta gas processing plants.

AviSun Corp. has chosen New Castle, Del., as the location for a new 100 million lb/yr polypropylene plant.

• • •

Scientific Design Co. has announced development of a new process for direct oxidation of benzene to produce phenol, said to require low capital investment and eliminate byproducts, making it suitable particularly for small package type installations.

• • •

Celanese Corp. of America plans to double the productive capacity of its Pampa, Texas, higher acrylate esters unit. When completed later this year, the new facilities will be capable of producing 14 million lb/yr of 2-ethylhexyl acrylate, butyl acrylate, and glacial acrylic acid.

• • •

Phillips Carbon Black Ltd. has engineering and design work under way on a 22 million lb/yr carbon black plant to be built near Durgapur, India, with completion expected in the next 18 months.

• • •

Amoco Chemical Corp. has joined with Petrofina in forming a new company, Amoco Fina, which will build a new lubricating oil additives plant on the banks of the Scheldt, south of the Fifth Harbour at Antwerp, Belgium.

• • •

The Bank of America will grant Maruzen Oil Co. a $5 million loan to build a petrochemical plant at Chiba, near Tokyo, Japan. Maruzen also has announced that the Commerz Bank of Western Germany is to loan $3.6 million for an ethylene plant. All these arrangements are subject to approval by the Japanese government.

• • •

A new synthetic rubber plant has been officially opened at Shell's Pernis, Netherlands, refinery, with an initial capacity of 60,000 ton/yr of styrene-butadiene type rubber.

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Suntide Refining Co. is building a 60 million lb/yr styrene unit at Corpus Christi, Texas, capable of expansion to 75 million lb/yr when needed. Completion is planned for the spring of 1962.

• • •

United Carbon Co. and Sid Richardson Carbon Co. have completed licensing agreements for the use of United Carbon processes by Richardson for manufacture of oil furnace carbon blacks, which are to be used in a 50 million lb/yr plant to be built by Richardson at Big Spring, Texas, adjacent the Cosden Petroleum Corp. refinery, with completion planned for mid-1961.

• • •

Ethylene Plant Described

"Lummus at PCI," a new booklet describes the 200 million lb/yr ethylene plant of Petroleum Chemicals, Inc. at Lake Charles, designed, engineered, and built by Lummus Co. utilizing the Lummus-developed process. Today, a little more than a year since the Lake Charles plant went onstream, Lummus is engineering a 50% expansion program which will raise capacity to 300 million lb/yr. Write to The Lummus Co., 385 Madison Avenue, New York 17, N. Y.

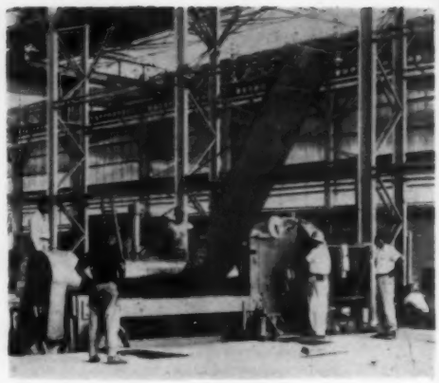
Thompson Ramo in Europe

Thompson Ramo Wooldridge Inc., a USA pioneer in industrial automation, will manufacture and sell its RW-300 Digital Control Computer in the European Common Market through a newly formed corporation headquartered in Paris, Compagnie Europeenne d'Automatisme Electronique. The venture includes Compagnie Generale de Telegraphie Sans Fil (CSF), Intertechnique of France, and TRW.

The new corporation is part of TRW's International Division, which is headed by George W. Fenimore as general manager. President of the new joint-venture is Robert A. A. Remillon, formerly president of the CSF subsidiary, Compagnie Europeenne des Tubes Telephoniques. Vice president is Dr. Eugene M. Grabbe, formerly senior staff consultant on automation for TRW.

Total capitalization of the new firm is $1.5 million. In addition to manufacturing and marketing the RW-300, CEAE will provide applications engineering for the computer and for associated equipment.

To date, eighteen RW-300 systems—80% of all existing industrial digital computer installations in the world—have been sold and are in operation, six of them in Europe.



New Swecomex plant at Guadalajara includes this pinch type plate bending roll capable of forming cylinders from steel plate 1½ in. thick and 120 in. wide.

Mexican Heat Exchanger Plant

A new $2 million manufacturing facility for process equipment has been dedicated at Guadalajara, Jalisco, Mexico, by Swecomex S.A., a new firm of mixed capitalization and the majority ownership in the hands of Mexican interests. Minority capital interests are held by two USA firms, Anaconda Co. and Southwestern Engineering Co. Both are providing strategic technical assistance in the planning, organization, and operation of the plant.

Equipment designed and manufactured by Swecomex will include shell-and-tube heat exchangers, surface condensers, steam jet ejectors, distillation columns, evaporators, and crystallizers.

Dow Offers Technical Service

Dow Chemical International Ltd. S.A. has established a latex technical service facility and quality control laboratory in Rotterdam, Netherlands, to be operated in conjunction with the new styrene-butadiene plant now under construction in the Third Petroleum Harbour. M. C. Carpenter, manager of the Paint Group of Dow Coatings Technical Service in the USA, has been named manager of the Rotterdam facility.

World Rubber Group Formed

The continued dynamic growth of the synthetic rubber industry world-wide has brought about the formation of an International Institute of Synthetic Rubber Producers. It was organized by 15 USA and other synthetic rubber producers, with the principal office in New York, under the direction of Bancroft Henderson as managing director. A subsidiary office is planned for Europe.

World production of this material has increased almost four times in the past decade, growing from 440,331 long tons in 1949 to 1.64 million long tons in 1959.

The purpose of the Institute is to provide an effective means for promoting international trade of synthetic rubber and to fill the need for a forum in which manufacturers and technicians all over the world may exchange technical information. Membership is open to any interested and qualified manufacturer of synthetic rubber.

Cities Service Petrochemicals

A new Petrochemical Development Division has been established to coordinate all petrochemical activities of the Cities Service system. It will be charged with the responsibility of keeping abreast of developments world-wide and to recommend commercial areas in which the company will function.

A group of 55 scientists and technicians have been transferred from Petroleum Chemicals, Inc. to Cities Service Research and Development Co. This group will be the core of the company's petrochemical laboratory at Lake Charles, La.

Simultaneously, a central planning division has been established in New York City, under the direction of Dr. L. R. Hellwig, formerly head of engineering research for Petroleum Chemicals Inc. Two other PCI men have also transferred to New York: Alfred L. Regnier becomes manager of project analysis and Robert M. Henderson becomes manager of market research.

NEW McCullough FRAC-NOTCH CUTTER

helps improve production as much as 30 times

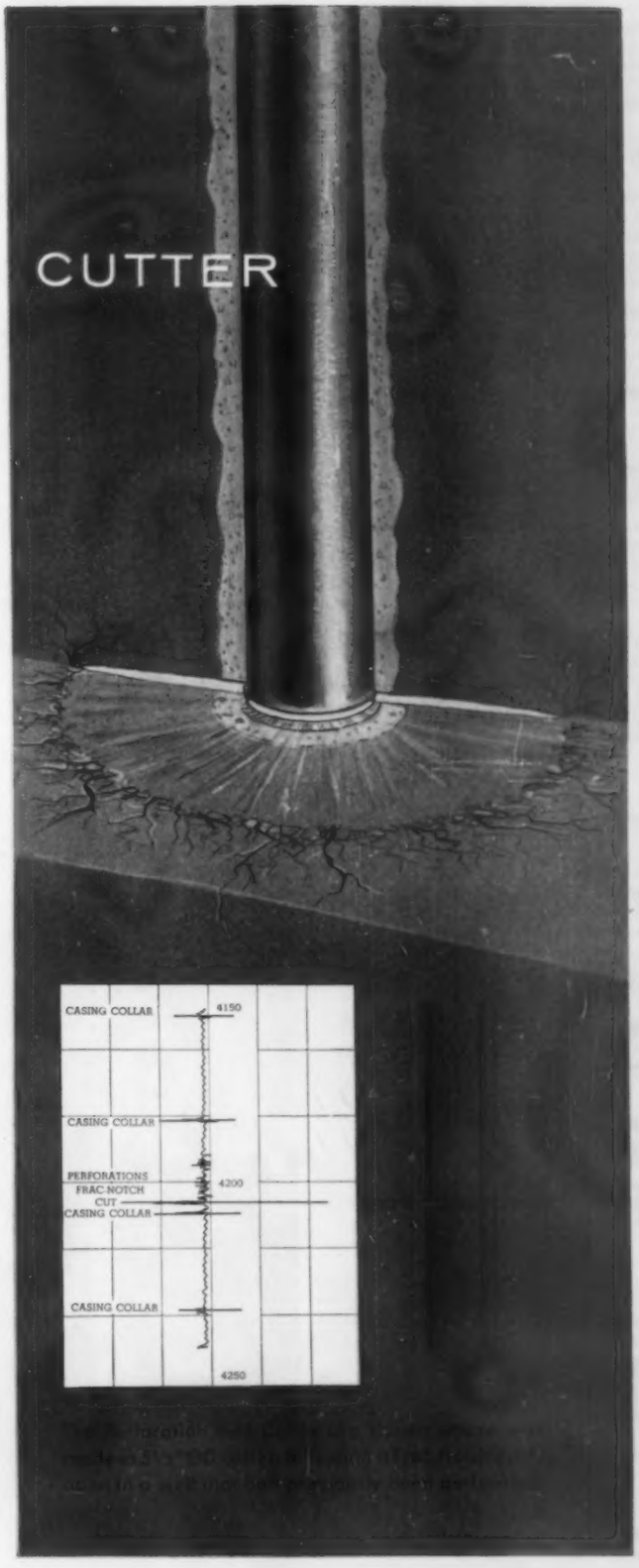
This newly developed electric wire line tool, utilizing an improved jet cutting process, makes it possible to get up to 100 times more effective hydraulic fracturing power—to improve production as much as 30 times over other methods.

McCullough's Frac-Notch Cutter cuts a circular notch horizontally through casing, cement and as much as 15 inches into the formation around the entire circumference of the well bore. Concentration of hydraulic fracturing power in this notched area results in the application of enormous pressure against the formation. For example—a hydraulic fracturing pressure of 5,000 psi applied to a notch in 5" ID casing results in more than 1,400,000 lbs. pressure against the formation in the circular notch—fracturing thousands of square feet of oil zone.

In wells treated by this process, where 25 bbls. per day was expected, production is over 700 bbls. per day.

The Frac-Notch Cutter is fast and economical. Additional economy is realized because it is usually run on the same Service Unit set-up immediately after collar and radioactivity logging for correlation and depth control.

It will pay you, as it has many others, to look into the advantages of the McCullough Frac-Notch Cutter. Call us today!



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INTERNATIONAL NEWS AND NOTES

ABU DHABI: BP Trading Ltd. has called for tenders from British, Continental and American suppliers for pipe to link the Umm Shaif crude oil collecting platform with the degassing station and tanker loading terminal on Das Island. Each producing well will be linked with the platform by 6 or 8-in pipeline, and the main line, about 20 miles in length, will be of 8-in diameter. The value of this order is put at around £500,000.

ARGENTINA—Italy's State-owned ENI may win another contract to drill for oil in the Comodoro Rivadavia area under extended payment terms. The Italians now hold one 300-well contract from Argentina's State agency YPF with three-year terms, and are reported negotiating for seven-year terms on a second contract.

ARGENTINA—Ing. Marcos Soifer, head of the Exploitation Department of YPF in Argentina, foresees the nation's crude-oil output equal to consumption by 1961, but only with the help of private companies. He foresees consumption of oil and gas (in terms of oil equivalent) to 18.6 million cubic meters in 1961, and to 22.2 million in 1964, from 17.6 million this year.

Against this, he foresees oil and gas production of YPF and old concessions of 10.8 million cubic meters this year, 12.6 million in 1961, and 14.9 million in 1964. Foreign companies with production contracts will produce 3.69 million cubic meters this year, 6.5 million in 1961, and 15.3 million in 1964, he foresees.

ARGENTINA — Second Argentine petrochemical plant to be built by Imperial Chemical Industries Ltd. has been announced in London. The new $16 million plant will make polyethylene plastic. Ethylene (raw material for polyethylene) will be drawn from local light-oil distillates, and the plant will be operated by Duperil, Imperial Chemical's Latin American subsidiary. During 1959 the company said it would spend $6.6 million on an industrial site and sulfuric-acid plant near San Lorenzo, about 200 miles north of Buenos Aires—the polyethylene plant to be at the same site.

ARGENTINA—A Shell spokesman in London said his company is "ready" to make a further investment of $56 million in its Argentinian operations. Shell already has $84 million invested in the country, including $28 million earmarked for developing its refining operations in Buenos Aires.

ARGENTINA—The Cologne press reports that, during the recent visit of Argentine President Frondizi to West Germany, a West German-French consortium signed an agreement for the expenditure of $140 million for crude production in Argentina.

AUSTRALIA—Magellan Petroleum Corp. (representing USA interests) has been granted petroleum permits on five million acres in the Amedeus Basin of Australia's Northern Territory, bringing the company's total holdings in Australia to more than 20 million acres. The company has applications pending on an additional 1.4 million acres in the Amedeus Basin. Magellan has now completed aerial magnetometer and gravity surveys of large portions of the company's permit areas in the Great Artesian Basin of Queensland, and recently completed drilling a 4,500-ft stratigraphic test in properties in Queensland's Win-Ton area.

AUSTRALIA—Reichhold Chemical Industries and Hercules Powder Co. expect to have a joint chemical plant in operation at Springvale, Victoria, by 1961. Output of resin-based emulsifiers will be utilized by Australian Synthetic Rubber Co.

AUSTRALIA—Following 27 applications approved last February for government subsidies, the Australian government has approved a further allocation of a million dollars to oil-search companies—bringing to $2¼ million proposed expenditures for the current year in West Australia, Queensland, Victoria, and Papua. The new allocations are for geophysical surveys and stratigraphic drilling. For the 1960-61 period, an additional $450,000 has been allocated on behalf of seven companies. Tentatively, the government had allocated $1.4 million for 1960-61 and $225,000 for 1961-62.

AUSTRALIA—Union Carbide Australia Ltd. will raise to 30 million pounds per year (from 15 million pounds) the capacity of its polyethylene plant being built at Altona, Victoria. First stage of the plant will be in production, as planned, by mid-1961. Growth of polyethylene demand has been exceeding expectations.

AUSTRALIA—Another small gas flow has been reported in the Pickanjinnie well near Roma, Queensland, at 4,400 ft. Drilled for Associated Australian Oilfields and Papuan Apinaipi Petroleum, the well is going deeper.

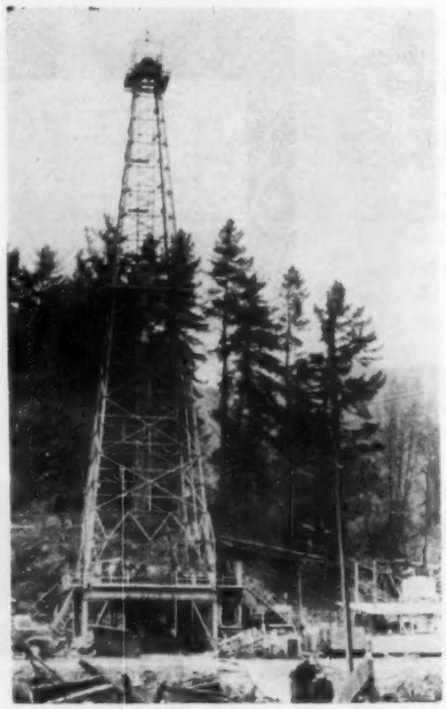
AUSTRALIA—Shell Oil Co. plans to build a $700,000 terminal at South West Rocks, Kempsey, New South Wales, with tankage for 4.2 million gallons of various grades of gasoline and 875,000 gallons of distillates.

AUSTRALIA—The failure of some American companies operating in Australia to disclose their profits would not help Australia-USA relations, according to Mr. W. E. Knight, head of the US Embassy's economic bureau in Canberra. He said the more shared partnerships between Australian and USA interests, the better it would be. It would improve relations between overseas investors and the public in Australia.

General Motors-Holdens Ltd., which announced a profit of $34 million in June, will not have to reveal future profits, since the purchase by the American parent company of Australian-owned preference stock.

Mr. Knight said USA investments in Australia would fall off if limits were placed on the amount of profits which could be taken from the country. However, USA businessmen would understand a temporary limitation if Australia met with some difficulty in its balance-of-payments situation.

AUSTRALIA—Consolidated Zinc Pty Ltd. and Monsanto Chemicals (Australia) Ltd. are forming a new jointly owned chemical manufacturing plant at Monsanto's Rozelle site in Sydney, expected to be in production by mid-1961. Initially the new company will produce fluorocarbons, chemicals which for years have been made in the United Kingdom by Imperial Smelting Corp., a member of the Consolidated Zinc group and one of the two UK manufacturers of this material.



The first deep test well for the BP-Shell and Todd Petroleum Development Co. Inc. is drilling at Mengaene, near Nuhaka, on the North Island of New Zealand. The BP Group is the managing partner for the company.

COLOMBIA—Two new pipelines are to be constructed in Colombia. Gases Naturales de Colombia SA plans to complete in 1961 a 220-kilometer 10-in. gas line from Cicuco fields to Barranquilla. The gas will reduce industrial fuel costs in the area by 25%. The company is capitalized at 45 million pesos—one-half from Colombian Petroleum Co. and the other half from Barranquilla industrialists. An oil products line, to cost 20 million pesos, between Barrancabermeja and Bucaramangua will be financed by German and local Colombian capital. Presently the country has five crude lines of about 1,300 km in length, and four products lines of about 400 km.

COLOMBIA—The Board of the Banco de la República, on May 13, 1960, fixed a new rate of 6.50 Colombian pesos per U. S. dollar as the purchase price of foreign currency resulting from exportations of coffee, bananas, hides and precious metals. Since capital imports of oil companies are subject to the same rate as such exports, they must now be sold to the Banco de la República at the new rate of 6.50 per dollar. The former rate was 6.10 per dollar. Consequently, oil companies importing capital into Colombia will receive more local currency in exchange for their dollars.

FRENCH SAHARA—No. 103 Ohanet is the second stepout from Mobil et al.'s eastern Sahara discovery, for which the French firm CEP is operator. The new well is two miles north of Ohanet No. 1 (a 1,900 b/d producer) and two miles south of No. 102 (drilling below 1,700 ft).

FRENCH SAHARA—Algerian crude exports in the first quarter of 1960 came to 1,328,129 metric tons. Some 1,214,788 tons left Bougue and 113,341 tons left Philippeville. The value is $20.41 per ton.

FRENCH SAHARA—Start of crude shipments from the Sahara to the USA was announced following negotiations between French officials and Cities Service Co. Sale of oil was by SN Repal. The first movement around the end of March this year reportedly was only a "token" shipment to pave the way for "larger" ones.

GERMANY (WEST)—Following a 23% increase in West German product demand during 1959, Shell expects this to rise by 19% this year—to 27 million tons. Deutsche Shell's new 50,000 b/d refinery near Cologne is now onstream—with expected capacity to be raised by 1965 to 80,000 b/d. Of Shell's 5.3 mil-

(Continued on page 96)

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(*Continued from page 94*)

lion tons of products sold during 1959, only 2.5 million were produced in Germany.

GERMANY—Total drilling in West Germany was 752,866 meters last year, a drop from 782,273 meters in 1958. The total included exploration drilling of 183,357 meters, down from 221,777; extension drilling 134,763 meters, down from 138,208 meters; production drilling 427,928 meters, up from 410,423 meters; and "deviation" drilling of 6,818 meters, down from 11,865 meters.

Petroleum reserves at the start of this year stood at 72,930,000 metric tons, including 57,888,000 metric tons of proved and 15,042,000 tons of probable reserves.

Crude-oil production in 1959 was 5,102,758 tons, or 14,528 tons a day, up 15.1% from 4,431,596 tons in 1958. Crude-oil refinery throughput capacity last year was 29,961,000 tons, up from 27,011,000 tons in 1958; it is to rise to 46,131,000 tons by 1963. Refinery output was 21,288,521 tons, a gain of 43.9% from 1958.

GREECE—British Petroleum, in partnership with the National Bank of Greece, has signed an agreement for oil prospecting and exploitation rights over a land area of 5,715 square kilometres (about 2,000 square miles) in the province of Aetolia-Akarnania and the islands of Lefkas and Cephalonia in western Greece.

BP and the National Bank have jointly formed the Aetolian Oil Co. SA to hold the concession, and operations will be conducted by BP Exploration Co. (Greece) Ltd. Under the agreement, the exploration rights last for eight years, by the end of which time a development concession must be taken out. This concession would be for 30 years with a possible renewal for a further 10 years. It is planned that geological survey work will commence shortly.

INDIA—A $30 million contract has been awarded The Lummus Co. to build India's first synthetic-rubber plant, near Breilly, Uttar Pardesh. With construction to begin within months, project calls for butadiene and styrene raw-material units, as well as a copolymer plant for final synthetic-rubber product.

INDIA—Phillips Carbon Black Co., newly formed joint venture of Phillips Petroleum Co. and Duncan Bros. & Co. Ltd., of Calcutta, will construct a carbon-black plant near Durgapur, India, with an annual capacity of 22 million pounds. The new company is owned 30% each by Phillips and Duncan Bros. and 40% by private investors.

INDIA—An independent firm of geological consultants, DeGolyer and MacNaughton, has confirmed that the recoverable crude oil reserves amounting to 29 million tons (approximately 217.5 million barrels) have so far been proved to exist in the Upper Assam areas to be developed by Oil India Private Ltd. The estimate is based on the latest appraisal of potential production data obtained from Nahorkatiya and Moran oil fields. The additional reserves indicated, but not confirmed by testing hitherto, have been appraised at approximately 13 million tons (approximately 97.5 million barrels). In addition it is hoped that the further drilling planned will establish the presence of a further 20 million tons of recoverable reserves and that together, these reserves will enable the combined oil fields to produce at a maximum rate of three million tons per annum (approximately 60,000 b/d) for an estimated minimum period of 15 years. The maintenance of this rate of production will, however, depend on the continued success of the drilling still to be carried out. It has been arranged that DeGolyer and MacNaughton will reappraise the reserves at six-monthly intervals.

IRAN—Tehran sources report a number of international firms have submitted bids for oil exploration concessions in Zones 8, 14, and 18. Representatives of a Belgian firm were shortly expected to arrive in Tehran to enter negotiations with the Iranian authorities.

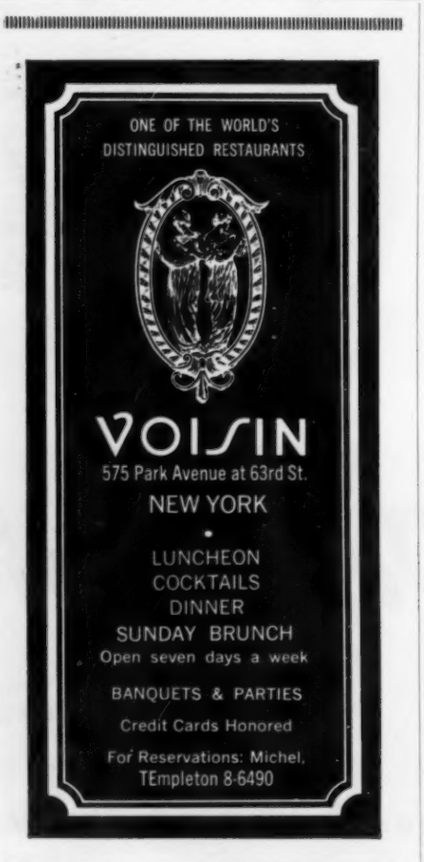
These areas were previously opened for bids some months ago and subsequently closed for lack of takers. Recently the success of the government's company, NIOC, at the Qum field has revived interest. A 20,000 b/d well there on the 30-mile structure indicates the oil possibilities of this area, although its geology is far removed from most Middle Eastern fields.

IRAQ—Total Iraqi imports rose to a value of US $362.2 million in 1959, up from $307.4 million in 1958. Revenues from oil exports also increased, whereas returns from other exports showed a considerable decline. Revenues paid the government of Iraq as its share of petroleum exports amounted to $242.5 million, compared with $223.7 million in 1958. Other Iraqi exports (excluding petroleum) amounted to $32.1 million, a decline from $39.9 million in 1958.

ISRAEL—At Kidod, 5 km north of the Zohar gas field in the Negev desert of Israel, the first well drilled by Naptha Israel Petroleum has yielded seven million cubic feet of gas per day—twice the yield of the Zohar wells; and the reservoir (on a different structure) is larger. Reserves at Zohar are now estimated to be equal in calorific value to one million tons of oil. Drilling has started at Daya, 20 km southwest of Zohar, and plans for gas lines from Zohar are again being studied.

ITALY—Amoco (Standard of Indiana) is reported to have offered to purchase for 9.75 million lire the combined facilities of the Camangi group, whose parent company is Italia SpA. Through Italia, Camangi owns at industrial Cremona a 1.3-million-ton refinery which includes two topping units, a catalytic desulfurizer, a catalytic reformer, a thermal reformer, an LPGas recovery plant, a fractionator, a polymerizer, and a gas-oil desulfurizer, as well as auxiliary power facilities and crude and product storage with a capacity of 444,290 cubic meters. At Al Porto Marghera (Venice) Camangi has a coastal deposit of 60,700 cubic meters. Another company in the group (Camangi Smc) owns a network of 830 service stations in central and northern Italy, currently under nine-year lease to Purifina Italiana. The Camangi group has been in financial difficulty for some time.

JAPAN—Negotiations are reported to have slowed down between Mobil Oil Co. and the Japanese firm Maruzen Oil Co. whereby Mobil was to lend Maruzen $5 million for the latter's proposed building of a refinery in Singapore in exchange for Mobil's offer to supply Persian Gulf crude on a long-term contract for the Japanese market. With Maruzen asking a 20¢ discount on the crude price, Mobil is reported to have offered only 15¢.



JAPAN—Cie. Francaise des Petroles has signed a nine-year contract with the Japanese for 23 million tons of Mideast crude, mostly from Iraq's Zubair field. As part of the deal, CFP has extended to Shin Asia (partly owned by Maruzen Oil) a $5 million loan for refinery expansion. Nippon Mining Co., a small refiner which is to build a 30,000 b/d plant, reports it has rejected a similar supply-loan package offer from CFP, Mobil, and BP.

LIBYA—Rated crude production in Libya currently is 69,185 b/d and 16.5 million cubic feet daily of gas. Some 33 drilling rigs are in operation and, as of mid-June, 32 productive oil wells and three gas wells had been found.

LIBYA—A tract of four concessions totaling 10,500 square miles offshore the Gulf of Sirte has been obtained by Atlantic Refining Co. Exploration blocks No. 86 through 89 range in size from 1,822 to 3,409 square miles.

LIBYA—The Bechtel Corp of San Francisco has been selected by Esso Standard (Libya) Inc. to build Esso's 100-mile $16 million crude pipeline from the Zelten field to Marsa el Brega. Operations will start late this year and the pipeline will be completed in about six months. Drilling additional development oil wells and building terminal facilities are planned. Esso Libya's objective is to begin exporting Libyan crude oil sometime during the first half of 1962.

MEXICO—Well informed circles in Mexico City have expressed the conviction that Mexico will shortly announce a shipment of oil to Cuba. The only question yet to be decided, they said, is how much and whether it will be refinable crude, which is in short supply in Mexico, or whether it will be residual fuel, which is in surplus.

MEXICO—Pemex director Roldan has confirmed that the Mexican oil industry is negotiating with Tennessee Gas Transmission to set up a pipeline in Mexico to carry Texas and Mexican natural gas to California. Roldan said no contract has as yet been signed because both countries are studying the legal problems connected with the 450-mmcf-per-day pipeline. A TGT spokesman agreed TGT is negotiating with Pemex, although the company has not filed an application with FPC nor has it immediate plans to do so.

MOROCCO—Construction has begun at Mohammedia, near Casablanca, of a 1.25 million-ton (25,000 b/d) refinery in which the Italian State ENI and a Moroccan government entity have equal shares. ENI has begun drilling in its exploration agreement area in the far south of Morocco, in Tarfaya province.

NETHERLANDS—Royal Dutch-Shell has opened a new $28 million 60,000-ton-per-year synthetic-rubber plant near its big Pernis refinery in The Netherlands. Facilities include styrene, butadiene, and styrene-butadiene units.

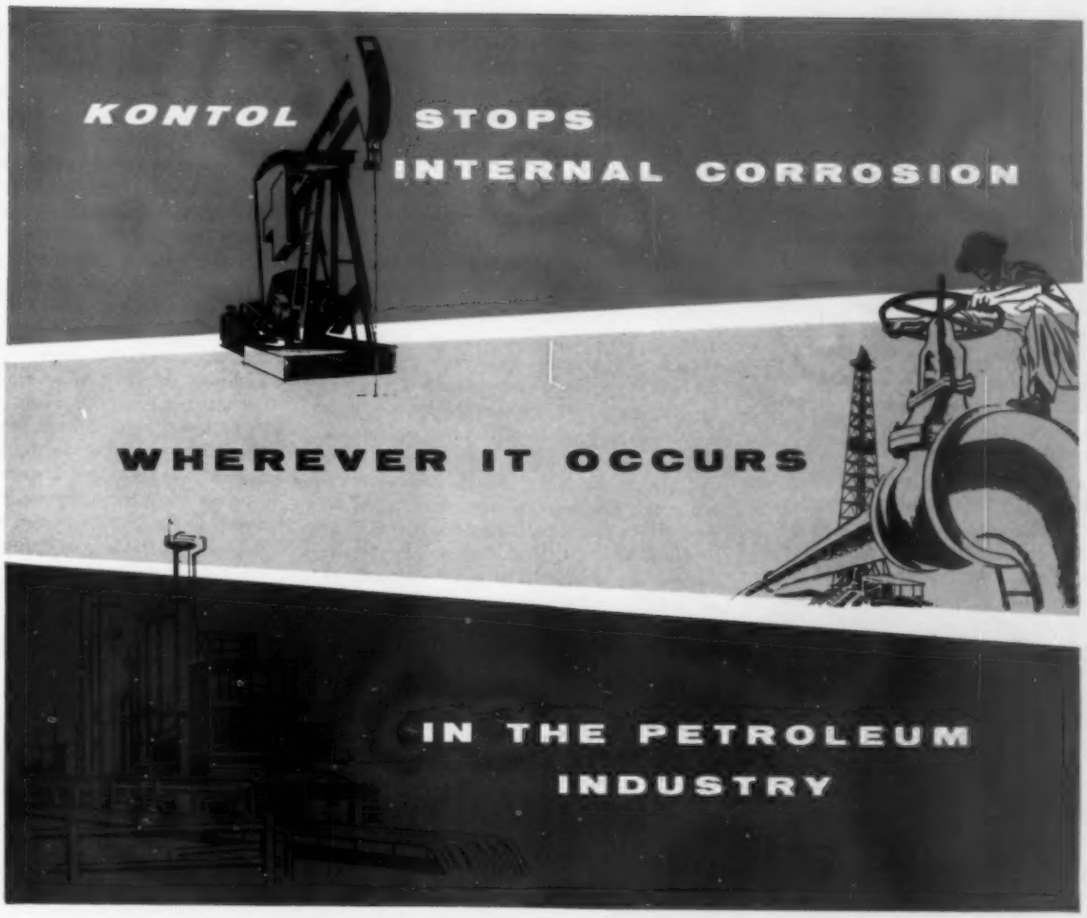
NEUTRAL ZONE—According to Saudi oil director Abdullah Tariki, Saudi Arabia will exercise its option to buy 10% of the stock of the operating company when the Japanese start commercial production offshore the Neutral Zone. Kuwait holds a similar option under its own Neutral Zone offshore grant to the Japanese-owned Arabian Oil Co.

NEUTRAL ZONE—The Japanese-owned Arabian Oil Co. has announced completion of its third offshore Neutral Zone test—a well flowing about 6,000 b/d. Wells No. 1 and No. 2 tested, respectively, 4,500 b/d and 6,000 b/d.

NEW ZEALAND—New Zealand is proceeding with the construction of its first refinery, with two-million-ton capacity (40,000 b/d), virtually sufficient for domestic demand. Initially this refinery was to be operated and 60% owned by Shell, with New Zealand investors owning the other 40%. Now it is proposed all oil-product marketers in New Zealand (Shell, BP, Caltex, Europa, Stanvac, and Atlantic Union) will be interested both financially and operationally.

PAKISTAN—Pakistan Shell Oil Co. has encountered high-pressure gas in Rasidpur No. 1 in the Sylhet district of eastern Pakistan—with the well below 11,800 ft.

(*Continued on page 104*)



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Oil's Outlook in an Era of Plenty

(*Continued from page 44*)

cession holders, a foundation for intelligent action would exist. Under these circumstances, application of sound business principles could do much to avoid conditions harmful to all concerned.

* * * *

Financial Interest in Oil

In recent months in which oil stocks have been selling at a low level because of lack of investor confidence, bankers and financial analysts have shown great interest in the oil situation. Edward Symonds, petroleum economist for the First National City Bank of New York, recently published a booklet titled "Life With A World Oil Surplus" and in late July addressed the Southwest Graduate School of Banking in the course of which he said in part:

To a less sophisticated group it might seem strange that the astonishing success of the recent exploration efforts abroad should have given birth to the most serious oil industry recession of the last quarter century. There is an obvious appeal in the argument that companies which have gone out to find out—and found oil—are in a stronger position than if they had only found sand and salt water; or that a company should be judged more on the growth of its reserves than on the growth of its earnings. But we bankers and economists know that this is much too innocent an approach.

The stock market, which is supposed to look at tomorrow rather than today, has shown how drastically it discounts the future earnings potential represented by the 250 billion barrels of proved oil and the untold volumes of natural gas that are now at the disposal of the oil companies of the non-communist world. Consider, for instance, what happened to the value of the total outstanding stock of a representative group of ten major oil companies. In the ten years ending in December 1957, they showed a five-fold increase, while the Dow Jones Industrial Average rose only half as fast. But 1958 and 1959 saw an abrupt end to this climb. The quotations began to drift uncertainly downward. Meanwhile the Dow Jones Industrial Average added insult to injury by continuing its climb toward an all time high. The first half of 1960 did little to improve the record, and some of the big institutional investors are still suspicious of oils.

What we all want to know, of course, is not what has happened, but what is going to happen; in oil as in other walks of life, history is a discipline, but prophecy is a delight. On this all I shall do is to remind you that movements on the exchange tend to be irrational and overdone—if they were not, money-making would be too easy and probably none of us would be here today. Like any other fashion, the fashion of selling oils was likely to bring a reaction. A number of people—particularly those who retain an obstinate, old-fashioned obsession over income rather then prestige—are now impressed by the fact that some of the solidly-established oil stocks have been selling at only 10 to 15 times earnings, compared with 17 for the Dow Jones Acerage, 20 or more for some of the chemicals and metals —and around 40 for some of the glamour stocks.

In any case, it is a mistake to read too much into stock prices, and into the short-term and accidental causes that give them their maddening fascination. But there has also been an underlying gloom in the industry itself. This can probably be traced back to a basic change of feeling—a feeling that energy supplies are now entering a new era —an era of plenty instead of poverty.

But I do not believe that we have now turned our backs for good on an era when the world seemed to be running out of oil, or that from here on our abiding problem will be to stop oil from running out of our ears. We may come to regard the finds in the Middle East and North Africa as exceptional; it is certainly true that no big oil fields have been discovered in the US for the last 30 years. Nor must we forget the outlook for demand. In spite of centuries of ceaseless effort, the desire for comfort and leisure has never been completely satisfied in any society. Whatever the methods used in continuing this effort in the future they will certainly call for more and more mechanical energy.

In America, we may not see much change in the energy pattern between now and 1965. But the progress of natural gas will be greatly affected by political developments. If the price is held down—and the necessary supplies are still forthcoming—the growth of gas could prove much faster. In Europe, oil and gas are likely to rise from about ¼ of total energy supplies to 1/3 by 1965. In the world as a whole, we expect oil and gas, which at the beginning of the century provided only a negligible fraction of the supply, to account for more than half the total energy used. In terms of coal equivalent, total demand would rise by almost 80% in 15 years—from 2,519 million metric tons in 1950 to 4,510 million metric tons in 1965.

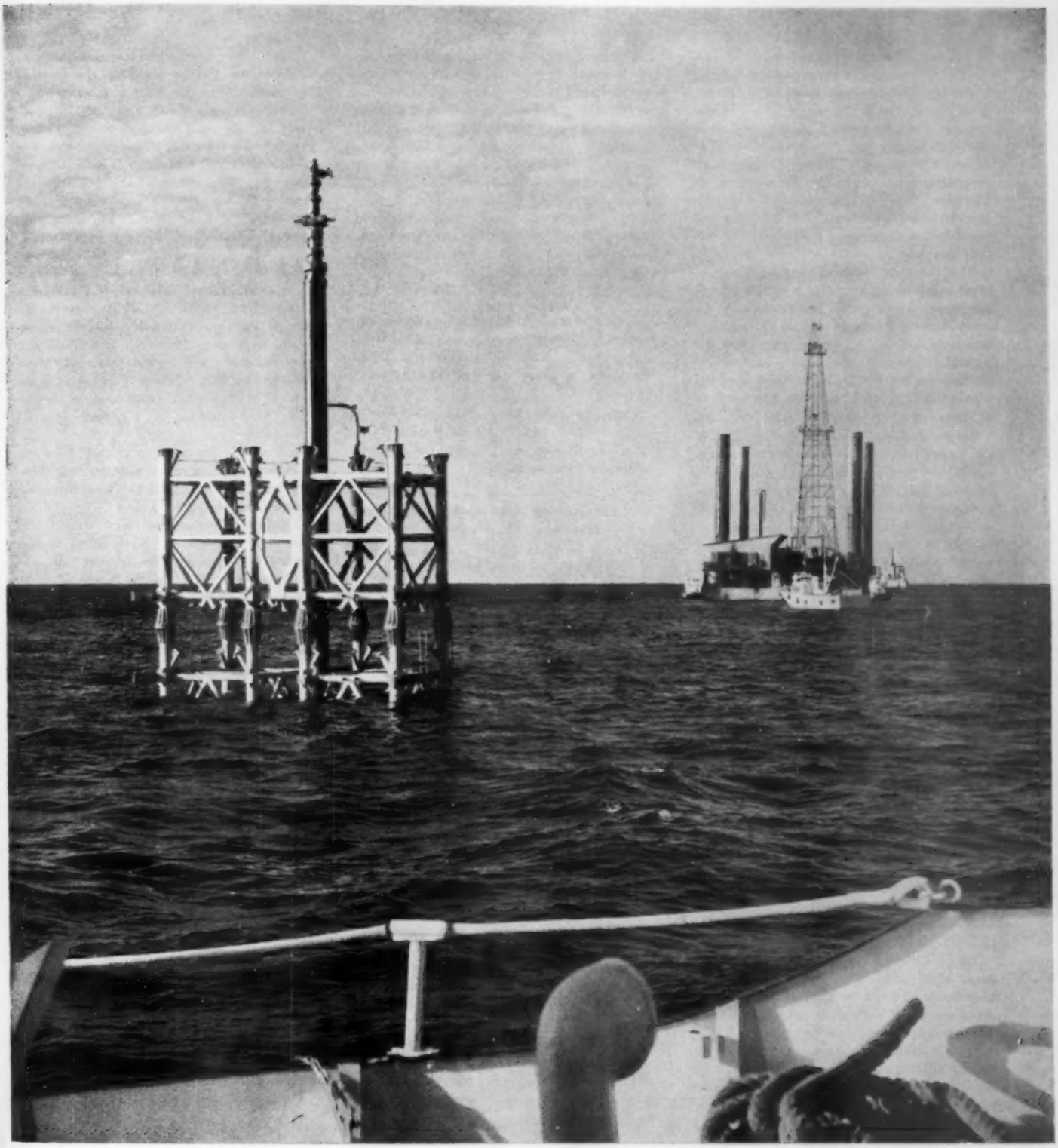
The prospect of expansion in the petroleum market—about 3% a year in the USA and 7% a year in the rest of the non-communist world—is one of the industry's greatest strengths.

The industry is finding new markets—there are now twice as many pleasure boats in this country as there were 10 years ago, and they provide a petroleum market of $160 million a year. The industry is developing new products; petrochemicals, a profitable postwar progeny, now account for at least 2% of volume and probably 2-3 times that percentage of sales. To press forward with these new developments, oil companies are already spending $300 million a year on research and will probably be spending twice as much by the end of the decade.

In spite of all the unknowns in the equation, I believe that the surplus capacity in the world today is still a manageable proportions. Oilmen have no need to suspect that (to borrow Joyce's phase) the angel of death has kicked the bucket of life from their industry.

The increasing calls, in the Congress and out of it, for a so-called national fuels policy are a direct result of the present energy surplus. Underlying these demands for the regulation of energy use is the assumption that economic forces can no longer be relied upon to bring about necessary adjustments between the different energy sectors. It is tempting to gallop off in an attack on this assumption, and to insist that market place pressures are quite sufficient to bring about any necessary changes. Unfortunately, this argument can have an unpleasantly Victorian ring. Nowadays we have to accept that neither land, nor labor, nor capital can be employed and shifted around with the freedom that Alfred Marshall and the other old masters used to describe. Nor is the consumer still the unfettered sovereign portrayed in the old textbooks. Particularly in Europe, where the coal industry is less flexible than in America, the capture of an established market by a newcomer such as imported oil calls for slow and difficult adjustments and is bound to arouse bitter resistance. But an expert report has recently been made on Europe's energy needs through 1975. It devotes a whole chapter to the case against a European fuels policy—and, I must add, to the case for keeping an open door to energy imports. It has not by any means enjoyed universal approval—there have been demands for a reconversion of oil-fired power stations back to coal, and for the selling of imported fuel oil at its "real" rather than "market" price. But I believe that it presents an unanswerable economic case. And the arguments against rigid government regulation, and against turning the present energy pattern into a strait-jacket, are at least as strong in America as in Europe.

What are the changes that the USA market could be insulated from the world influences that are tending to hold down energy prices? Many people hoped that the introduction of first voluntary and then mandatory import controls would set the stage for a sustained increase in domestic crude oil prices. The events of the last three years have been most disappointing to them. But in any case, in their preoccupation with the immediate foreign threat, they were apt to overlook domestic competition. Gas and coal have been hungrily eyeing the crude oil markets, and could be relied upon to move in strongly if crude oil prices got out of line. Shale oil in the USA and tar sands in Canada are only waiting for crude oil to raise the price umbrella so that they can become fully competitive. Nuclear energy has begun to nibble at the power station fuel business. In a market like this, it is hard to make profits but easy to price yourself out of customers. Too much reliance on import restrictions could prove ineffective and dangerous medicine.



ABU DHABI

A well head on the Persian Gulf. In the background, the barge "Adma Enterprise" which is currently drilling beneath the waters of the Gulf. The results are sufficiently encouraging to warrant the preparation of facilities for regular production. This stage should be reached by mid-1962.

BP

To meet the energy need that can now be clearly foreseen, spectacular amounts of capital will somewhere have to be found. This is true even in the present phase of cost cutting and investment paring—which is likely to endure for a number of years to come. The group of some 25 integrated companies on which the Department of Commerce bases its business investment projections will pour a total of $2.6 billion into plant and equipment in 1960—a rise of 6% over last year.

The domestic oil and gas industry may need to invest at a rate of some $8-10 billion a year by the end of this decade. To meet Western Europe's oil and gas requirements, some $3 billion a year may be needed. Allowing for other investment abroad, the industry's capital needs over the coming decade might add up to a total of as much as $150 billion in today's dollars.

In the unusually active period behind us, some 15% of the industry's long-term capital needs were raised from outside the oil companies. Even if parts of the investment effort can henceforth be scaled down, we cannot expect to see the industry covering all its future financial needs from internal sources. If it is to raise the necessary sums, it must be able to offer an attractive return to outside investors.

The basic strength of the oil industry stands out clearly when we examine dollar figures. Oil company earnings after tax were $2.8 billion in 1959, and oil is still the largest earner of all USA industry groups. Adding back amortization and depreciation, the cash flow has been, and promises to remain, even more impressive. In 1959 it stood at nearly $5 billion.

The earnings and cash flow figures indicate a solid basis on which to build a financing program. But this does not relieve the industry of one clear responsibility. Its capital needs are on such a scale that, like Caesar's wife, it must not only be well managed, but be seen to be well managed. It must not appear to be drifting along, in the words of a recent off-Broadway off-hit, simply criticizing the inevitable.

To my mind, this does not necessarily mean that startling new machinery will have to be created to manage the surplus that now exists both at home and abroad. There has been talk about introducing some kind of international prorating system. Unending difficulties would be involved in trying to get governments of producing countries, let alone of consuming countries, to agree on a system of limiting national production—except possibly that of Russia or of some other country not party to the agreement. But the fact remains that an adequate and sustained flow of capital can only be assured if the present surplus is so managed that it serves as a comfortable cushion of future supply, rather than a suffocating blanket of excess production.

All of us, particularly in the banking business and particularly in the Southwest, are watching with fascinated interest to see how the industry meets the dramatic challenge facing it. It has to show that it can treat the present world-wide surplus as a blessing, not a curse. It must do so without becoming ensnared in controls and regulations that would cramp its future growth—yet without running to such excess that the necessary investment funds would be scared away. This may sound a tall order. But it is one that has been met successfully in the past. The industry has got used to sudden changes in the pattern of production, trade and markets. It will undoubtedly continue to adjust rapidly to them rather than attempt to sweep back the tide.

* * * *

Financial analysts also have called in oil leaders to express their opinions on the situation. One such recent speaker was T. F. Bradshaw, vice president of The Atlantic Refining Co.

Comparing present conditions with those of the 1920's, Mr. Bradshaw recalled the "as is" agreement which he told the analysts contained these principles:

1. Each company was to retain the percentage of the market enjoyed at the time by the company.

2. Each producing area was to have the advantage arising from geographical position—that is, should sell in the nearest market.

3. Supplies for each market should be drawn from the nearest producing area.

4. Surplus production in any producing area was not to be "dumped" in other areas to the disturbance of the price structure.

5. No measures were to be taken which would materially increase the cost of producing oil.

Did the agreement work? Here I must draw upon the conclusions of Adolf Berle in his remarkable little book "The 20th Century Capitalist Revolution."

> "The fact was that from 1928 to 1939 the period in which the Achnacarry Agreement and its successor arrangements governed the petroleum supply of the world, there was peace and there was production, and there was distribution and there was a stable and reasonably acceptable price. By absolute standards the Agreement has to be accounted a success. . . . As an experiment in world economic government, the companies cannot on this record be accused of failure."

Mr. Bradshaw agrees that times have changed and that a new "as is" agreement would not work today. Unlike most of his contemporaries in the oil industry, he suggests that proration by producing nations may be an answer. He quoted the oil proration proposals set forth by Sheikh Abdullah al-Tariki, Saudi Arabia's director general of petroleum and mineral affairs with these objectives:

The stabilization of markets by the prevention of production in excess of market demand.

The prevention of economic waste caused by the unnatural depression of prices resulting from overproduction.

The conservation of an irreplaceable natural resource for the benefit of the particular country and for future generations.

I suppose most oil men regard the possibility of successful international prorationing as being slim. They point to the rivalry of the Arab and non-Arab Middle Eastern countries. They point to the necessity for developing the French controlled Sahara production, and the pressure for developing the new Libyan fields. Finally, they point to the possibility of creating a vacuum into which Russia may be all too willing to pour oil to create troubled waters, if I may mix a metaphor. There are difficulties in the way of any international economic agreement. Difficulties have not prevented the emergence of the European Common Market and the Outer Seven. The use of Russian oil as a political weapon, is, of course, a very real problem, but I believe we shall have to face that problem regardless of the means which are used to control Western oil. Perhaps we should remember that Russia is participating in the De Beers diamond control system.

I cannot forecast the form control will take; I am convinced that control of the surplus of some sort or another will become effective and in the relatively near future. Too much is at stake to allow the international oil situation to deteriorate into chaos. Too many powerful groups—both private and governmental—are too well aware of the implications of an uncontrolled oil situation to allow it to develop. I am not speaking of rate of return on oil company investments—I am speaking of the economic base of the free world.

Concluding his address to the analysts Mr. Bradshaw said:

1. The oil surplus is a blessing, not a scourge.

2. Too many people believe that oil profits will return to adequate levels only when the surplus has disappeared. The oil surplus is not going to disappear for many years, and I personally hope it never does.

3. A return to an adequate level of profits will occur when oil managements and governments learn how to manage the surplus effectively.

4. Because of the emergence of an intensified national interest in oil, I believe an effective international balancing machinery will be created in some form in the relatively near future.

5. Because of lessons learned in the immediate past, I believe both managements and states will use the present domestic tools effectively in the near future.

In more specific terms, it seems to me the transition phase may last a year or two longer. During this period oil earnings may be substantially aided by the long-needed stripping-down operation through which most oil companies are now going. In the somewhat longer-run—beginning with the effective control of the surplus—the oil industry will once more reflect its basic strength as the primary provider of energy to an energy-hungry world. END

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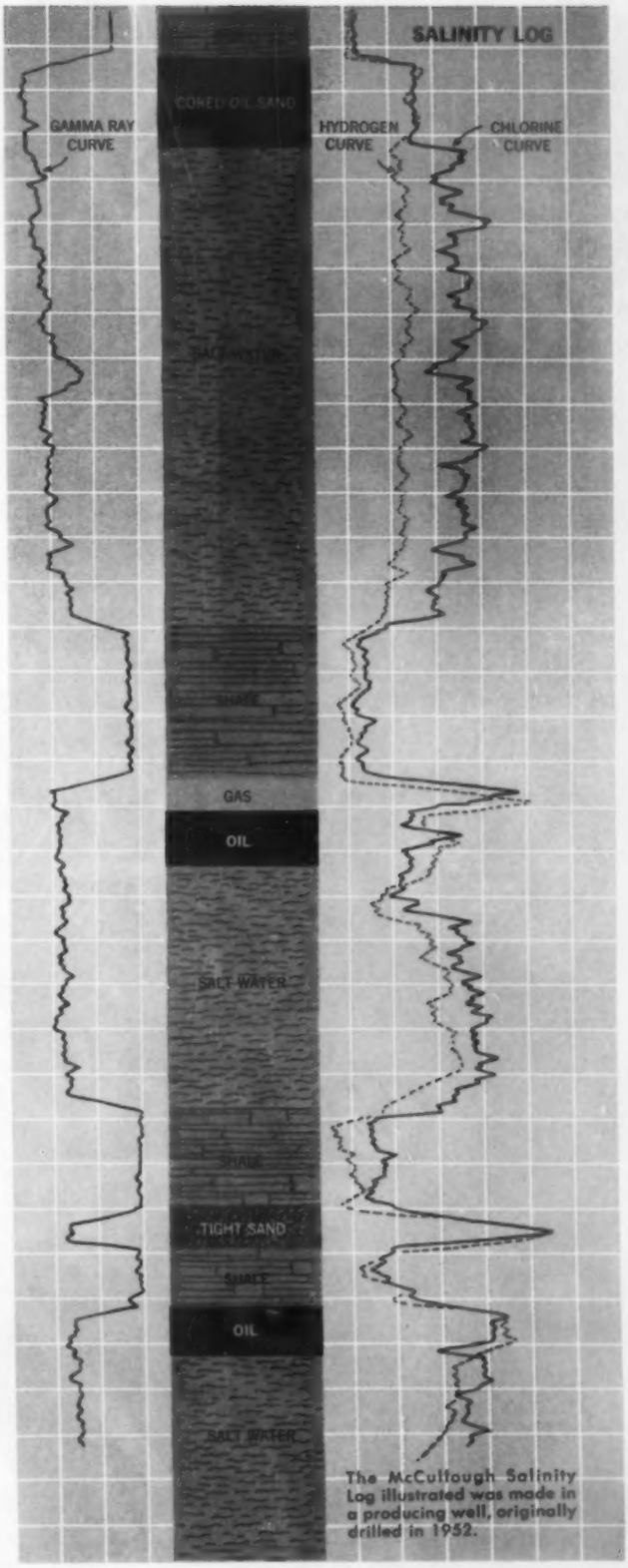

The McCullough Salinity Log illustrated was made in a producing well, originally drilled in 1952.

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(*Continued from page 96*)

PERU—Bank of America and Standard of California will share jointly 35% in the financing of the new Socal 12,000 b/d Gonchon oil refinery, 15 miles south of Lima. The remaining 65% Peruvian share will be financed by the Banco Popular in Lima.

PUERTO RICO—Gulf Oil Corp. said 10 new service stations will be opened about October 1 in the greater San Juan area as the first phase of its entry into marketing activities in the island commonwealth. The new units will be operated by independent Puerto Rican businessmen.

QATAR—Shell Co. of Qatar has discovered oil in its third Persian Gulf well, Idd el Shargi No. 2, 50 miles offshore and northeast of Doha. Testing continues, and further wells will be drilled on the structure.

SAUDI ARABIA—Aramco on June 13, 1960, produced its four billionth barrel of oil in Saudi Arabia. Saudi Arabia is one of four countries in the world to reach this cumulative total to date. Only the USA, Venezuela, and the USSR had previously passed this mark. Kuwait is on the verge of doing so.

SAUDI ARABIA—With six producers and one observation well shut in at its Manifa field, Aramco has also decided to suspend drilling at Safaniya, its first offshore field (now in production) for the remainder of 1960 and to concentrate on further "delineation development drilling" at Safaniya.

SPAIN—Ohio Oil Co., in association with Cia. Iberica de Petroleos of Spain and Spanish banking interests propose to build an $18 million 25,000 b/d refinery on the northern coast of Spain to provide a market for Ohio's large Libyan crude reserves. Spanish government is to hold 52% ownership and the remainder divided between Ohio Oil and its Spanish associates. Ohio Oil has a one-third interest in three gas wells and 13 oil wells in the Libyan concessions. The oil wells have tested as high as 11,500 b/d, but so far the company has not indicated plans for marketing the output. If proposal is approved by Spanish government, refinery would be scheduled for completion within months.

Cia. Iberica de Petroleos is a holding company which is partly owned and managed by the Fierro family, an influential Spanish banking and industrial group.

SPAIN—The Pure Oil Company has been notified that the Spanish Government has approved an operating contract permitting a three-company group to go ahead with oil exploration work on a 1,388,000-acre concession in Spanish Sahara on the northwest coast of Africa. Champion Oil and Refining Company is the operator and shares equal interests with Pure and Sun Oil Company. A year-long seismic exploration program will start immediately.

TURKEY—Kuleli No. 1, drilled jointly by the German firm Deilmann Petrol Ltd. and NV Turkse Shell 22 miles east of Edirne in northern Thrace, may prove to be European Turkey's first oil discovery. Though the well had an intermittent flow of gas, oil, and water in the Tertiary at 2,700 meters (about 8,850 ft), its commercial potential has not as yet been determined.

TURKEY—Mobil International Oil Co. (division of Socony Mobil Oil) has announced its affiliate in Turkey has discovered oil in a wildcat well 40 miles inland from the port city of Mersin on the Mediterranean coast. Mersin is the site of a 65,000 b/d refinery currently under construction. Discovery well Bulgardag No. 1 indicated on drill-stem tests a potential of 240 b/d of 36-gravity crude before acidizing and fracturing. The oil-producing stratum was encountered at about 4,700 ft. Bulgardag No. 1 is Mobil's first discovery after three dry holes and an extensive seismic program dating back to 1955. The well is being drilled deeper.

UAR—President Nasser has nationalized all Egyptian-owned importing and wholesaling enterprises which deal in pharmaceuticals and chemicals. Observers have interpreted the move as a beginning of Nasser's plan to nationalize all importing and wholesaling companies in the United Arab Republic.

UAR—The United Arab Republic's first deep-drilling unit, a Soviet turbodrilling unit for 9,800 ft, was rigged up at Rakhme, on the Red Sea coast. The rig was delivered by the USSR under the terms of the Soviet-UAR technical aid agreement.

UAR (Egypt)—Egypt has upped to $7 million its total subsidy for the General Petroleum Authority for the fiscal year beginning July (against $5.6 million for the 1959-60 period). In announcing the new GPA budget of $199 million (down from $200 million) along with other budgets autonomous public agencies, the economic minister said government subsidies are given to those who cannot fully rely on their own resources.

UAR (Syria)—A committee for negotiating with the West German firm "Concordia" on exploitation of the Suwaidiyah field in northeast Syria met in Damascus on July 4 for the first time under the chairmanship of the Syrian Minister of Industry Wajih-al-Samman. The committee will study relevant information submitted to it by the Directorate General of Minerals and the General Petroleum Authority. A meeting with representatives of Concordia is scheduled to take place later.

USSR—The Russians expect to have an undisclosed number of 19,000-ton tankers built in Poland's shipyards during 1961-65. They will be part of 122 vessels of various types totaling 830,000 tons under a Russian-Polish agreement.

RUSSIA: Stavros Niarchos, Greek tanker owner, has arranged a "contract of affreightment" to ship a total of 2 million tons of oil from the Black Sea to ports in Europe and Japan between August 1960 and the end of 1963. This is stated to be easily the largest transaction for Russian oil transport recorded on the London tanker market. The deal provides for the movement of 1,200,000 tons to European ports by end-1961 and 800,000 tons to Japan over 1962 and 1963.

USSR—Moscow's Central Statistical Board reports first-half 1960 crude output climbed 15% over the

(*Continued on page 106*)

Another achievement in gravity measurement from LaCoste & Romberg

Now for the first time, gravity surveys of inaccessible areas can be made from the air, using a LaCoste & Romberg airborne gravity meter. This new meter requires no gyroscopic stabilization platform. Its accuracy is better than 10 milligals.

Commercial airborne surveys are now available from Fairchild LaCoste Gravity Surveys, Inc.

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Loffland In Africa

Loffland Brothers is increasing its operations from two rigs to six as North Africa's oil development increases in scope. Fabrication is now being rushed on two new rigs which will be trailer-mounted and especially-equipped for desert operation. They will drill for Esso Standard (Libya) Inc., bringing to four the number of Loffland rigs running for Esso Libya. Loffland has two other rigs in Libya, one for Mobil Oil Co. of Canada, Ltd., and the other for Oasis Oil Co. of Libya.

The two new rigs, being fabricated by Unit Rig and Equipment Co. in Tulsa, will be identical to Rig V-55 now drilling for Esso southwest of Behghazi. All major equipment is mounted on trailers equipped with 63-inch-high by 23-inch-wide flotation tires for use in deep sand. Separate trailers will carry the Mid-Continent U-36A drawworks, portable mast, mud pumps, substructure, and utility unit.

Lost Circulation Kit

Magnet Cove Barium Corp. has developed a new kit designed to explain the functioning of lost circulation materials in oil well drilling operations and to aid in the selection of proper materials for various drilling conditions. The kit consists of samples of the ten basic materials, a listing of the product applications, and directions for correlating the product uses with the various types of lost circulation zones encountered in oil well drilling. Magcobar also has published a Lost Circulation Bulletin. Write Magnet Cove Barium Corporation, P. O. Box 6504, Houston 5, Texas.

Soviet 16,730-ft Turboelectric

In the Caspian Sea, an offshore hole was spudded recently which is to be drilled with an electric bottom-hole drill to a record depth of 16,730 ft. At 8,200 ft, a "double elctrodrill," designed by Baku engineers, is to take over. The electrodrill was designed in the USSR in 1945, and is now used chiefly for the penetration of deeper layers.

Drilling and Bumper Jar

Hunt Tool Co. has developed a combination drilling and bumper jar to perform a number of downhole drilling and jarring operations which formerly required two tools. The primary uses are: as a drilling jar, for freeing stuck drill pipe, collars, or bits; as a feed-off jar; for maintaining controlled weights on the bit; and as a bumper jar, for releasing other tools in the string. Write the Hunt Tool Co., P. O. Box 1436, Houston, Texas.

Licenses Valves

Grove Valve and Regulator Co., Oakland, Calif., has licensed two additional European firms to produce its G-4 gate valve. The new licensees are Nuovo Pignone of Firenze, Italy, and Robert Cort & Son, Ltd., Reading, England. Grove's French subsidiary, Grove France S. A., in Paris, has been producing G-4 valves since early in 1958.

Multiple Orifice Injection Valve

Willis Oil Tool Co. has developed a multiple orifice injection valve which retains the advantages of a needle valve's micro-fine adjustments without their cutting and chattering disadvantages. The valve meters fluids from a minute flow to full line flow with less than a one-quarter turn of the stem. Non-corrosive metering discs are capable of withstanding extremely corrosive fluids.

Bowen Casing Roller

Bowen Itco, Inc. has published Bulletin 6200 to describe its patented casing roller designed to recondition and restore collapsed, buckled or dented well casings to normal I. D. and roundness. Write Bowen Itco at P. O. Box 4587, Houston 13, Texas.

Baker Transfers Research

Baker Oil Tools, Inc. has transferred its research headquarters to Houston from Los Angeles and plans a major expansion. H. H. Fisher has been named chief research engineer succeeding J. R. Baker who has been re-assigned as manager of the company's new Mexican subsidiary, Baker-Herramientas Petroleras, S. A.

Heads International Division

Michael L. Mandeville has been appointed president of the International Division, U. S. Industries, Inc. He had been executive vice president of the division and succeeds R. S. Wright, who was recently appointed vice president for international trade of the parent company.

Tests Turbine for Fracturing

Laboratory tests of a gas turbine engine being considered as a new power source for Halliburton Company's mobile fracturing units is now underway. For a few months it will be tested under simulated field operations at the firm's Duncan, Okla., technical center. Then it goes into several months of field service on a fracturing truck, serving as the power sources for one of the unit's two pumps. Tests are being made in cooperation with General Electric Co., manufacturer of the 900 hp unit.

Acetonitrile Information

A new 56-page guide book, a complete source for acetonitrile information, has just been published by Sohio Chemical Co. It includes reactions, physical properties, information on specific uses, and a bibliography containing 134 references. Write Sohio Chemical Co., Fort Amanda Rd., Lima, Ohio.

New Polished Rod

Axelson Division of U. S. Industries, Inc., has produced a polished rod for severe conditions where corrosion and abrasion have presented serious difficulties for operators. The rod is made from a chromium-nickel-molybdenum alloy, precipitation hardened to a Rockwell C reading of about 40. The tensile strength average is 130,000 psi.

True Equipment Costs

"Low First-Cost versus Low Ultimate Costs," is the title of a new pocket-size booklet which discusses the question of "when is a low bid really low?" and points out the multitude of factors which must be considered to arrive at the proper answer. For copies, write to Western Supply Co., Heat Exchanger Division, Tulsa, Okla.

API Expands Abstract Services

The Central Abstracting Service of the American Petroleum Institute will be expanded beginning Jan. 1, 1961, provided sufficient interest is generated in the oil industry, Frank M. Porter, API president, has announced.

This expanded service would cover both USA and foreign patents as well as exploration and production publications, USA and outside USA.

Since its establishment in 1954, the service has provided basic coverage on refining literature. More than 140 sources from all over the world—in German, French and Russian as well as English—are scanned regularly. Over 12,000 pertinent abstracts are published annually in bulletin form.

If the plans for expanded coverage are justified by orders from oil companies, the API service will then issue three bulletins of abstracts each week. The refining patents service would involve abstracting approximately 5,000 USA and 9,000 outside-USA patents per year. Countries to be covered include Australia, Belgium, Canada, France, Germany, Great Britain, Netherlands, Italy, Union of South Africa, the USSR, and, eventually, Venezuela.

Plently Of Oil To Be Recovered

To presently proved oil reserves amounting to some 30 billion barrels could be added another 44 billion from application of known improved recovery methods and, with the addition of 14,822,000 bbl to primary reserves by conventional gas and water injection under current economic conditions, this would result in future recovery from existing oil fields in the USA of as much as 90 billion barrels. This is the conclusion of University of Texas petroleum engineer Paul D. Torrey, whose survey reveals the additional oil probably would come from those states in which these improved secondary-recovery methods have not as yet been applied.

Although from 1946 through 1959 the USA increased its proved reserves by more than 50%, all the world's other oil-producing countries upped theirs many times as much—resulting in the USA dropping to fourth place from first with respect to proved reserves, according to Torrey, who concludes the USA has abundant oil. Only the "actual" discovery of reserves outranks the development and application of fluid-injection methods in contributing additional reserves to the USA. "In many states it is by far the most important single factor in maintaining the oil industry in those states."

New Indian Rubber Plant

The Lummus Co. has been awarded the contract to build India's first synthetic rubber manufacturing plant near Bareilly, Uttar Pradesh. The Lummus Co. Ltd. of London will direct the $30,000,000 project for Synthetics and Chemicals Ltd., a company formed recently by the Firestone Tire & Rubber Co. and Kilechand Devchand and Co. Private Ltd., a Bombay banking and industrial firm. Construction work on the project will commence within several months, he added. The contract calls for units to produce butadiene and styrene, two of the principal raw materials, as well as a copolymer plant to manufacture the final product—synthetic rubber. Lummus also will construct all the plant utilities and offsite facilities. While Lummus will design the plant for an initial annual capacity of 20,000 tons, it will be "rapidly expandable" to 30,000 tons. Technical divisions of the Firestone Tire & Rubber Co. will furnish the basic engineering and "know-how" for the butadiene, styrene and copolymer units.

Bendix Acquires Mexican Firm

The Bendix Corp. has acquired a controlling interest in Disenadores y Constructores, S.A. (Dicosa), one of Mexico's leading tool-and-die firms. Automotive air-brake equipment, carburetors, and other components will be added to the present Dicosa product line, according to the Bendix announcement, in order to enable the company to serve the growing Mexican automotive manufacturing industry. In addition the company expects to maintain its position as a leader of the Mexican tool-and-die industry, the announcement added.

Officers of the company, whose name is being changed to Bendix de Mexico S.A., are Alfonso Galan, president, and Ricardo Beltran, executive vice president. They have been the founder-managers of Dicosa, which is located in Mexico City.

1,500 HP Drawworks

The first 1,500 hp drawworks manufactured by Gardner-Denver Co. has been sold by Jones & Laughlin Supply Division to B. L. McFarland, Inc., Midland, Texas drilling contractor, as part of a rig capable of drilling to 20,000 ft. Other major components include a 3-engine sectional compound, three Waukesha Mode VLROBU standard oil field power units, two Gardner-Denver 1,000 hp slush pumps, and a Gardner-Denver rotary table. The equipment is combined with a 142 ft Lee C. Moore mast.

The newly introduced Gardner-Denver Model "1500" single drum drawworks has eight forward and two reverse hoisting speeds and four forward and one reverse speed to the rotary table and catshaft. The drum capacity of the new drawworks with a 1¼-inch drilling line is 4,400 ft. Air controls are used on the drawworks, with hand and foot throttle conviently located at the driller's position.

The skid mounted drawworks is 24 ft long, 9 ft 8 in. and 8 ft 1 in. high. Weight of the drawworks without accessories is approximately 54,000 pounds.

U.S. Tax On Well-Head Gas Out

A tax on natural gas in Texas, called the "severance beneficiary tax," which was expected to pile $7.5 million into the state treasury during its first year, was declared unconstitutional by a Texas state district judge. To be appealed immediately and expected ultimately to wind up in the US Supreme Court, the tax has been paid under protest during the past eight months principally by interstate pipeline companies, and has yielded $6,302,591 thus far. The tax, passed during 1959, charges a 1.5% impost on the value of gas as it leaves the well. In declaring against the tax, the judge said "The US Supreme Court repeatedly has held invalid the imposition of a tax upon the privilege of engaging in interstate commerce."

(*Continued from page* 104)
comparable 1959 period—to 70.7 million tons. Gas output in the same period rose by 29% to 7.9 trillion cubic feet.

VENEZUELA—Clearing up the somewhat ambiguous position vis-a-vis proposed Cuban purchase of Venezuela oil, Dr. Juan Perez Alfonzo, Venezuela's oil minister, says "We offer our petroleum at posted prices at the port of embarkation. Petroleum shipped from Venezuela is paid for in cash. It can go anywhere—to Canada, China, or Cuba."

A government official has reaffirmed Venezuela's long-standing policy not to sell its oil on a barter basis. This statement followed an earlier report by the Cuban Oil Institute president that such a government-to-government deal was in the works. Several months ago Venezuela turned down a similar barter deal with Brazil.

VENEZUELA—Drilling operations are being resumed by Phillips Petroleum Co. and Pantepec Oil Co., CA on their jointly held 18,000-acre El Roble concession in the eastern State of Anzoategui, according to G. K. Stewart, Pantepec president. Development drilling to tap the prolific Merecure sands of the El Roble structure was discontinued some seven years ago by the Venezuelan Ministry of Mines and Hydrocarbons as a gas-conservation measure. Phillips Petroleum, operator of the Phillips-Pantepec property, recently obtained government approval of a plan for gas conservation, thereby reopening the area for development. The El Roble area comprises a 30,000-acre structure owned about 50% each by Creole Petroleum and Phillips-Pantepec. Phillips acquired its interest in the property from Pantepec in 1956 under an agreement in which the latter company reserved certain net profits interests in Merecure production.

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YUGOSLAVIA—Crude imports in the first quarter of 1960 came to 168,117 metric tons, against 170,822 tons in the same 1959 period. Imports this year came from USSR, 142,267 tons; Iraq,. 25,875 tons; and Bulgaria, 975 tons. Full-year 1959 imports were 619,093 tons, including 411,272 from USSR, 169,139 from Iraq, 20,722 from Egypt, 11,785 from Bulgaria, and 6,175 tons from Venezuela.

Esso Warms Brazil

A low-priced cook stove, scarcely larger than a teapot, is warming the hearts of Brazilian housewives and heating up new kerosine business for an affiliate of Standard Oil Co. (N. J.).

The tiny stove, simple in design and efficient in use, came on the market in Brazil in a modest way. Its sponsor, Esso Standard do Brasil, Inc., reasoned that promotion of economical oil stoves would increase kerosine sales.

Arrangements were made with a Brazilian manufacturer to produce a test quantity. After a few thousand went on sale in hardware and department stores, and at service stations in Rio de Janeiro and Sao Paulo, frantic orders for more followed within days as campers and housewives warmed up to a new convenience. By midsummer last year, 150,000 little oil stoves were cooking in Brazil, and demand continued to mount.

In rural Brazil, traditional cooking fuels are charcoal and wood. Traditional chores for housewives are tending their fires and scouring the blackened bottoms of pots and pans. Hence an odorless, soot-free, easy-to-light, low-cost oil stove found a ready market.

Stamped out of sheet metal, the Jacare stove (so called because Esso Brasil's trade-mark is an alligator) has an economic as well as a convenience feature. It is estimated that 400,000 of them will soon be burning in farm houses and "gaucho" camps.

The Jacare stove, which runs 18 hours on about a quart of fuel, consists of a cylindrical base which serves as its fuel reservoir, a ring of yarn-like cotton wicks around a central burner, on which a cooking vessel sits. A side lever adjusts the flame.

A similar stove—the mei foo, or "bright flame"—served as a sales stimulant for another Jersey affiliate, Standard-Vacuum Oil Co., after World War II. Introduced in Hong Kong, Japan, Malaya, India and East Africa, the "mei foo" stove has been sold by the carload.

Heavy Oil To Be Scarce

Esso has notified its residual fuel-oil customers of the possibility of a shortage of heavy fuel oil during the third 1960 quarter along the USA east coast. "The import allocation now announced of 250,000 b/d for the third quarter of this year is about 10% less than the average imported in the same quarter of 1959," said Esso, "and limits the industry to about the same volume of heavy fuel oil as it imported in the same period three years ago. Since the allocation makes no allowance for the accumulated year-to-year decline in domestic production, the total supply available for East Coast consumers in the third quarter of this year will, we believe, be almost 100,000 b/d less than in the comparable 1957 period."

On Russian Trip

Eight American oil company executives flew to Russia Aug. 1 under the East-West exchange program sponsored by the USA Department of State. The visitors were to spend the month of August in a tour of Russian oil fields, refineries, and research installations over a wide area, including off-shore drilling in the Caspian Sea. The American Petroleum Institute helped with arrangements and will aid in arranging a reciprocal trip later this year for a Russian group.

In the party are W. W. Keeler, executive vice president of the Phillips Petroleum Co.; Ira H. Cram, senior vice president, Continental Oil Co.; George S. Dunham, director, Socony Mobil Oil Co.; W. M. Elias, vice president, Pan American Petroleum Corp.; George F. Getty, II, president, Tidewater Oil Co.; George T. Piercy, head of the petroleum economics department, Standard Oil Co. (N. J.); Neal J. Smith, vice president, Chevron Oil Co.; and Dr. Noyes D. Smith, Jr., vice president, Shell Development Co. Alex Gakner and Robert Ebel of the Department of the Interior also were in the party.

FOR RELIABLE, UNFAILING ELECTRIC OPERATION... It's the HYDRAMOTOR® valve, designed by General Controls for lines up to 12" diameter and offering the advantages of single-unit, sealed-in-oil hydraulic ram power that's controlled by simple 2-wire circuitry.

Electro-hydraulic power operation eliminates complicated linkages and gearing, as well as need for outside air or gas supply—and it's fail-safe because the valve returns to safe position by spring force if power is interrupted. Ideal for use in cold weather, the Hydramotor is available in a low temperature unit designed for ambient conditions to –40°F.

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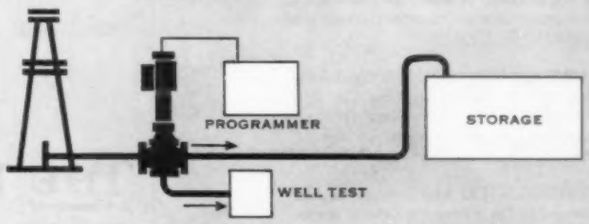
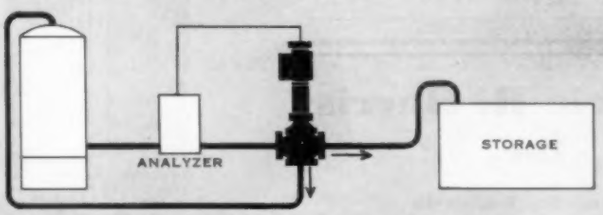
THREE BASIC TYPES of hermetically sealed Hydramotors are available in dust proof, drip proof, explosion proof and weather proof models: **Standard Hydramotors** provide open, closed, or in-between positioning. **Three-way 2-position units** provide for diverting flow from a common source to either of two outlets. **Three-way 3-position Hydramotors** carry flow from well to production, to test sampling or secondary tank, or to shut off. Hydramotor valve actuators are manufactured in a range of 180 to 6000 pounds of stem thrust and in a stroke range of ⅝" to 4½". Valve bodies of cast iron, cast bronze, cast carbon steel, stainless steel and other alloys are available in 150, 300, 600, 1500, 3000 and 6000 lb. ASA ratings.

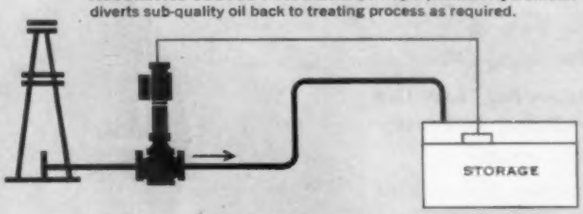
Write today for complete information. Ask for Bulletin 608.338.



WELL TESTING, 3-way 2-position Hydramotor valve samples rate and quality of flow on command or through programming equipment. The 3-way 3-position Hydramotor not only diverts flow but also provides full shut off for well shut in.



AUTOMATIC CUSTODY TRANSFER, 3-way 2 position Hydramotor diverts sub-quality oil back to treating process as required.



TANK SWITCHING, a standard Hydramotor controls level in storage tanks.

OIL COMPANY STAFF CHANGES

J. O. Bower

F. L. Leroy

JOHN O. BOWER has been elected president and chief executive officer of Colsag Corporation, parent company of Colombian oil interests jointly owned by Socony Mobil Oil Company, Inc., and Texaco, Int. **FRANK L. LEROY** has been elected vice president and general manager of Colsag's operating subsidiaries, Colombian Petroleum Co. and South American Gulf Oil Co. He succeeds Max E. Crawford, who has returned to Texaco, Inc. and has been assigned to Caracas as manager of the Venezuelan producing division of its subsidiary, Texas Petroleum Co. Mr. Bower's headquarters are in New York, and Mr. Leroy's are in Bogotá, Colombia.

MARSHALL McDONALD, vice-president and financial coordinator of Sinclair Oil & Gas Co. has been elected a member of the board.

JAMES E. MOSS has retired as director of the division of transportation of the American Petroleum Institute, and **B. H. LORD, JR.,** has been appointed as his successor.

W. T. HUGHES, JR., secretary of California Texas Oil Corp. has been appointed associate general counsel.

PAUL E. GEISER, Houston, has been promoted to the newly created position of general manager of petrochemical manufacturing for Continental Oil Co. Formerly manager of the detergents division, he will continue to make his headquarters in Houston.

DR. ALAN C. BATCHELDER has been appointed manager of chemical licensing in Shell Development Co.'s licensing division in New York.

J. G. HOUGH has been promoted to general manager of petrochemical sales for Continental Oil Co., with headquarters in New York City.

J. E. TRIGG, partner in Trigg Drilling Co., Oklahoma City, has been elected a director of Tekoil Corp., one of the few publicly-owned producing companies which specializes in secondary recovery of oil—principally by use of water-flood techniques.

ROBERT L. WALKER has resigned as division production superintendent for Shell Oil Co. in East Texas to become staff engineer for Reed Roller Bit Co. He will coordinate engineering efforts with sales. During 12½ years with Shell Mr. Walker served as a drilling engineer at the parent company's home offices in The Hague.

Albert Wright Jr.

R. L. Walker

ALBERT WRIGHT has been named producing coordinator of Standard-Vacuum Oil Co. succeeding **HARRY A. GIBBON** who has retired after 35 years service. Mr. Wright joined Stanvac in 1938 as chief petroleum engineer and assistant producing superintendent of its principal producing and refining subsidiary in Indonesia.

C. D. CARTER has been promoted to the newly-created position of export sales manager of Ethyl Corp. He will have charge of sales outside of the United States and Canada. Prior to his present promotion, he was in charge of Ethyl's Far Eastern sales, and he will continue to have that responsibility.

WILLIAM K. WHITEFORD, president of Gulf Oil Corp., has been elected a director of The International Nickel Company of Canada, Ltd. He has been a member of the advisory committee of International Nickel since February.

F. F. WRIGHT, executive assistant in charge of conservation and proration in the general office exploration department of Sinclair Oil & Gas Co. in Tulsa, has been named assistant manager of West Texas division in Midland. He succeeds O. G. Simpson, who has been transferred to New Orleans as assistant manager of the Southeastern division.

Henry C. Calhoun, executive assistant to L. L. Ware, vice-president and exploration coordinator, succeeds Mr. Wright.

A. J. SENEC has retired as manager of Tidewater Oil Company's eastern division economics department. He had completed a total of 42 years of service.

J. BRIAN EBY, geologist, and **WALTER L. WILLIAMS,** petroleum engineer, have joined Bradco Oil & Gas Co. and Bradco Associates, Houston.

JOSEPH F. MUELLER has joined Keplinger and Wanemacher, petroleum engineers, Tulsa. He will prepare reserve estimates and special reservoir studies. Recently he has been engaged as reservoir engineer in the Cody, Wyoming office of Pan American Petroleum Corp.

H. B. BROWN has been elected an administrative vice president of Gulf Oil Corp. and appointed coordinator-transportation, responsible for the coordination of all methods the company uses to transport crude oil and petroleum products.

JACK A. CONNORS has been appointed California division drilling engineer of Camay Drilling Co. He was formerly with Shell Oil Co., International Drilling Co., and most recently as an independent consultant in Hobbs, New Mexico.

WILLIAM S. DAVIDSON, JR. has been appointed manager of Tidewater Oil Co.'s eastern division transportation department. He succeeds **ALLEN L. PIPER,** who was recently transferred to the company's western division.

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C. D. Carter

H. O. Woodruff

HOMER O. WOODRUFF has been appointed general manager of the domestic producing department of Texaco Inc. in the New York offices, it was announced by A. W. Baucum, vice president in charge of the department.

Mr. Woodruff joined Texaco in 1933. Following various assignments in California, he served as assistant manager of the domestic producing department's Pacific Coast division from 1949 to 1956. He was assistant general manager at Tulsa for a year and then transferred to New York as assistant to the vice president in charge of the department.

E. F. BATTSON, New York City, has been elected president of Refineria Panama, S.A., owned jointly by a wholly owned subsidiary of Continental Oil Co. and interests of National Bulk Carriers, Inc. It will operate a $30,000,000 refinery now under construction in the Republic of Panama. Mr. Battson is a former director and vice president of Continental Oil Co., who retired in 1958 but who has since served the company as a consultant on various projects.

H. R. SMITH has been elected a vice president of Cities Service Refining Corp. A veteran refinery engineer, Mr. Smith has served as general superintendent of the refining company since 1948.

JACK C. HARDY, JR., a member of Sun Oil Co.'s legal staff for 18 years, has been named assistant general attorney for Sun's Gulf Coast production division at Beaumont.

(Continued on page 111)

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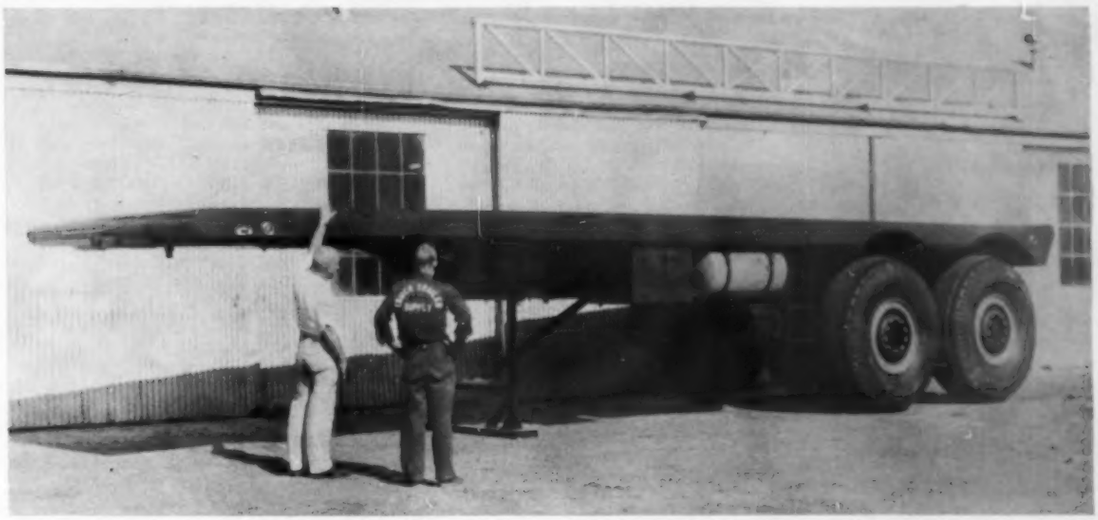

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New Westinghouse Motor Starter Has six features For Greatest Safety

Latest addition to the Westinghouse line of motor starters, the new NEMA 12 Life-Line combination starter has been developed by Westinghouse to provide far greater personnel safety, discourage tampering, and yet be readily accessible for maintenance. For example:

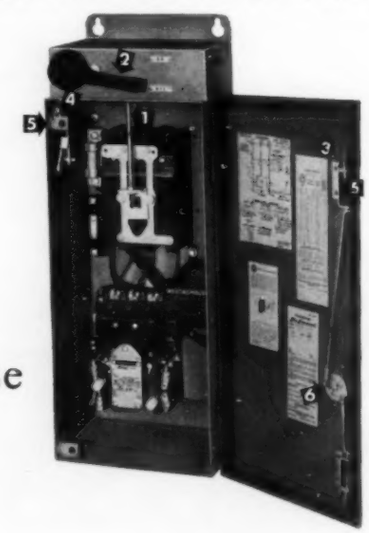
Disconnect is permanently attached by tie rod (1) to On-Off handle . . . is *not* disengaged by opening door. This assures complete safety when handle is padlocked (2) to prevent operation.

Door must be fully closed and sealed (3) before On-Off handle will operate disconnect. However, safety release (4), fully clear of exposed electrical parts, permits operation of On-Off handle and disconnect with door open.

Interlock assembly (5) prevents door from opening when handle is at On. (If desired, this feature can be defeated by removal of spring from assembly.) Door can be opened (6) only with screwdriver – not bare hands – preventing unauthorized tampering.

Other features: molded nylon handle, dustproof enclosure, ample internal wiring space for extra overload relays and excess capacity transformer, full accessibility from front, and standard Westinghouse quality components throughout.

This new starter is obtainable in five sizes of three models for different voltage needs. In addition, a complete range of other types of motor controls comes from Westinghouse. For more information, see your Westinghouse distributor. Or write for Catalog 60-C, Westinghouse Electric International Co., 40 Wall Street, New York 5, U.S.A.



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F. C. Smith

J. E. Swearingen

L. W. Moore

F. O. Prior

STANDARD OF INDIANA REORGANIZES

Standard Oil Co. (Indiana) plans an extensive corporate reorganization, effective January 1, 1961, subject to Internal Revenue Service clearance and to stockholder approval. The reorganization will:

1. Make Standard Oil (Indiana) exclusively a parent company concerned with broad management policy and with the coordination of subsidiaries that deal with all aspects of the oil business. The parent company will have no direct operating assets such as it now has in the Midwest.

2. Combine all product refining, transportation, and marketing operations and assets of Standard and its wholly owned subsidiaries, Utah Oil Refining Co. and The American Oil Co., in a single company with unified management and generally with common trade marks and brands. This company will be The American Oil Co. L. W. Moore, now president of American Oil, will continue as president and chief exceutive officer.

The new operating organization will use the American Oil name and related brands and trade marks. In 15 Midwest states the parent company has for many years owned the right to the exclusive use of the Standard Oil name and will continue to use and protect the Standard name by marketing in the Midwest through a Standard Oil division of The American Oil Co.

Officers of the parent company will include: president and chief executive officer—John E. Swearingen, now parent company president; executive vice presidents: Robert C. Gunness and George V. Myers, now parent company executive vice presidents; vice president—Dwight F. Benton, now parent company vice president of sales; vice president—S. A. Montgomery, now parent company vice president of manufacturing; and financial vice president—David Graham, now parent company financial vice president.

The officers of American Oil will include: president and chief executive officer—Mr. Moore, now president of American Oil; executive vice president—F. Cushing Smith, now parent company director and general manager of supply and transportation; vice president—J. C. Ducommun, now parent company director and general manager of manufacturing; and vice president—Wm H. Miller, now parent company director and general manager of sales.

Headquarters of both companies will be in Chicago. Standard Oil is now headquartered in Chicago, American Oil in New York City, and Utah Oil Refining in Salt Lake City.

Standard Oil (Indiana) is a refiner, transporter, and marketer of petroleum products in 15 middle western states; American Oil, in 28 eastern, southern, southwestern, and western states; and Utah Oil Refining, in five northwestern states. Altogether they have 13 sales regions and 12 refineries.

The reorganization generally will not affect other affiliated companies' operations concerning crude oil and natural gas exploration, and production, and purchasing in this country and abroad; domestic crude oil pipeline transportation; manufacturing and sales of petro-chemicals and liquefied petroleum gas, and with foreign refining and marketing. These activities are carried on by Pan American Petroleum Corp., Pan American International Oil Corp., Indiana Oil Purchasing Co., Service Pipe Line Co., Amoco Chemicals Corp., Tuloma Gas Products Co., and Amoco Trading Corp.

American Oil Company to Combine Markets of 3 Present Companies
UTAH OIL REFINING COMPANY
STANDARD OIL COMPANY (Indiana)
AMERICAN OIL COMPANY
Limited American Oil Marketing

Oil Company Staff Changes

(*Continued from page* 108)

I. E. LEVINE has been elected vice president of California Research Corp., in charge of the chemicals research department. He succeeds **M. Q. COPE** who has transferred to the California Chemical Co. **H. M. LAVENDER** has been named manager, chemicals research division, Richmond laboratory, replacing Mr. Levine. **J. F. SENGER** has been appointed manager, process and engineering division, Richmond laboratory, succeeding Mr. Lavender. **E. B. CHISWELL** of California Chemical Co. has been named to succeed J. F. Senger as senior coordinator, process design and engineering, San Francisco office.

V. W. FLETCHER has been elected president of Asiatic Petroleum Corp., in succession to **S. J. VEENSTRA**, who has resigned to take a new position with Shell International Petroleum Co. in London.

DR. E. W. GARDINER has been appointed senior research coordinator—petroleum products department, California Research Corp., San Francisco.

ROBERT E. ROEHL has rejoined Cities Service Co. following a one-year leave of absence to serve as coordinator of transportation for the Oil and Gas Division of the United States Department of the Interior. Mr. Roehl will be with Cities Service International, Inc. He will coordinate foreign supply and transportation activities.

RAY V. LONG, from vice president of Vapor Recovery Systems Co. of Compton, Calif. to president and general manager, and H. Dickinson, from vice president-engineering to corporation vice president.

ROBERT H. SCHOLL, formerly executive vice president of Esso Standard, division of Humble Oil & Refining Co., a Jersey affiliate, to director of Public Relations, Standard Oil Co. (N. J.), and **STEWART SCHACKNE**, formerly public relations department manager, to Public Relations Counselor.

O. V. TRACY retired August 1 as president of the Esso Standard Division, Humble Oil & Refining Co. **WILLIAM W. BRYAN**, who has been in Houston as vice president for marketing on Humble's headquarters staff, succeeded Mr. Tracy as president of the Esso Standard Division.

R. E. Roehl

W. W. Bryan

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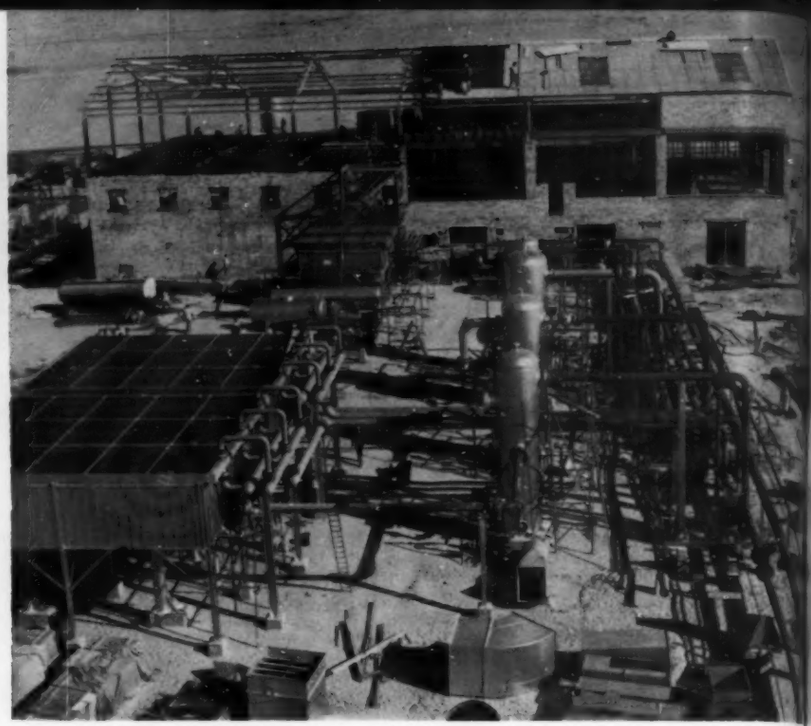
From simple manual devices to complex systems for completely automatic operation, Westinghouse supplies dependable equipment of advanced design for the many control needs of petroleum producers and refiners.

This modern control room for a large product pipeline is but one example. Its Westinghouse controls and indicating instruments are centralized for efficient operation. On the main console is push-button sequence control for seven pumping units at the station. The diagram panel on left wall provides supervisory control of a booster station located 56 miles downstream on the pipeline.

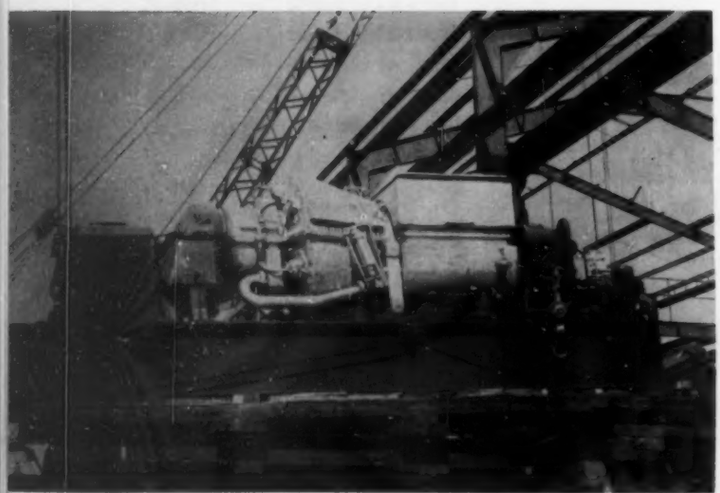
Besides a complete line of controls, Westinghouse manufactures thousands of other products for the varied operations of the petroleum industry. Among them: gas turbines for power generation, pipeline pumping and repressurization . . . motors for oil well pumping, pipelines, drilling . . . microwave systems for communication and remote control of pipeline stations . . . steam turbine-generator units for power and process steam . . . and many more.



View of main process area: vertical cylindrical gas scrubbers and gas coolers in foreground, turbine house in background.

Kuwait Oil completes new injection plant in Burgan Field

Aerial view of entire plant during construction period in 1959.



Left: Gas turbine unit in position before being rolled on to foundation.

Below: Pressurizing and air conditioning equipment on second floor of the turbine house at Burgan Field plant.

KUWAIT OIL CO., LTD. will complete a new gas injection plant this summer near the center of the Burgan Field in southeast Kuwait. It will be used to conserve gas and facilitate crude oil production. Gas will be taken from the first stage of the gas/oil separating process at nearby gathering centers and compressed to a pressure sufficient to allow this gas to be injected into the sub-surface oil reservoir.

At present an injection rate of about 100 mmcf/d of gas, measured at normal pressure and temperature, is proposed, at an injection pressure of 1,920 psig. This rate can be varied relative to the required injection pressure and an ultimate condition of 72 mmcf/d at an injection pressure of 2,350 psig is possible.

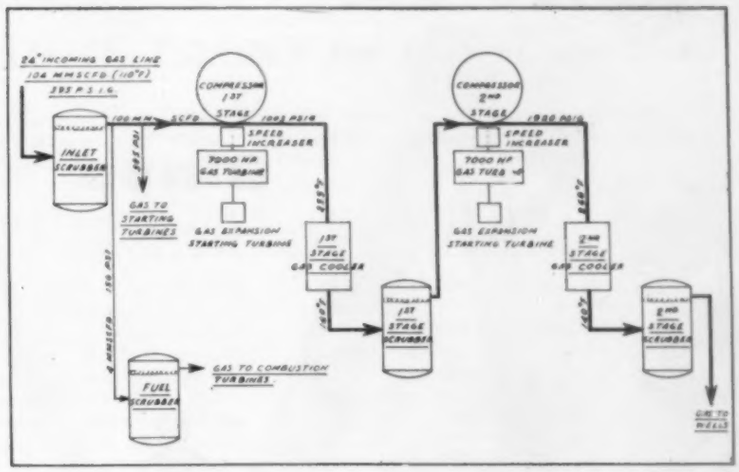
Gas comes to the plant through a 24-inch line and the total quantity (which includes fuel and utility gas) passes through an inlet scrubber to remove any entrained liquids. The main flow is then to the first stage compressor which at initial operating conditions will receive gas at 375 psig and 115 F and compress it to 915 psig with a temperature rise to 255 F. Flow continues through air-cooled intercoolers which reduce the gas temperature to 140 F. Subsequent flow through a first stage gas scrubber removes any condensates from the first stage compression.

Second stage compression is identical in flow but with gas inlet conditions of 900 psig and 140 F and discharge conditions after cooling of 1,920 psig and 140 F. After final scrubbing, the flow continues to an injection manifold from which individual injection lines connect to five wells.

Each multi-stage centrifugal compressor in this series-flow system is driven by a simple open-cycle non-regenerative single shaft gas combustion turbine which has a temperate rating of 7,000 hp. In the Kuwait maximum ambient temperature of 120 F, the power available from each turbine is 5,950 hp at a speed of 5,740 rpm increased through gearboxes to compressor speeds of 10,100 and 10,150 for the first and second stages of compression respectively.

The turbines are started by gas expansion turbines coupled to the main shafting system by air-operated clutches. These turbines use gas at 400 psig from the inlet gas scrubber through the utility gas system. This is expanded through the turbines out to atmosphere to accelerate the main turbines up to firing speed. The combustion chambers of the main turbines are supplied with gas at 150 psig from the fuel gas system and after firing the starting turbines are disengaged and the main turbines run up the full speed and power.

Electricity supply is 440-volt, 3-phase, 50-cycle, and is available for controls and electric motor driven auxiliaries. In the event of a complete failure of this normal AC supply, an emergency 75 KW diesel generating set is automatically started and connected to the emergency distribution panel. In addition, there is a 125-volt DC supply from batteries for the plant electrical control system and emergency lighting and equipment.



Simplified flow diagram of gas flow at Burgan Field injection plant.

In addition to the electrical service, instrument air is provided for the operation of instruments and controls. During normal operation, instrument air is obtained as a bleed from the main driving turbine axial flow compressors. At other times and during start-up, instrument air is supplied by an electric motor-driven air compressor arranged for dual control.

Hydraulic oil is used to operate the main plant block valves, re-cycle valves, plant pressure reducing valves and all major gas valves, the re-cycle valves being equipped with hydraulic positioners and operators.

An electric motor-driven hydraulic oil pump delivers oil at approximately 450 psig to an oil supply header, from which oil is distributed to each hydraulic valve operator and to the pressure control valve positioners and operators. The re-cycle valve positioners receive a supply from a low pressure header fed through a pressure reducing valve from the high pressure header. Hydraulic accumulators provide an emergency oil supply for operating critical valves which must function during emergency shutdowns.

Each turbine-compressor set has a separately integrated lubricating and seal oil system. Both seal and lubricating oil systems utilize the turbine lube oil reservoir and the main turbine gear pump as its source of supply together with a common air-cooled oil cooler and filter. After this point the two systems divide, the lubrication system then feeding to the various points on both turbine and compressor. Drains from these points connect back into the reservoir tank which is situated below the turbines.

Seal oil required for the shaft seals of each compressor is supplied by the lubricating oil gear pump from the turbine reservoir into the suction of seal oil pumps which boost the pressure to about 50 psi above the suction pressure at each compressor; i.e., 445 psi at the first stage and 1,053 psi at the second stage.

At each compressor a differential pressure regulator maintains the necessary oil pressure on the seal chamber. Oil which leaks through the outboard atmospheric seals drains back to the turbine reservoir after passing through a de-gassing tank. Oil which leaks through the inner high pressure seal drains through a trap back to the turbine reservoir through the de-gassing tank. Excess oil flows out of the seal chamber to the overhead reservoir from which it drains through a trap back to the turbine reservoir through the de-gassing chamber.

Fire Protection and Gas Detection. The gas used in this plant is odorless and colorless and therefore special measures are necessary to detect and warn operating personnel of dangerous concentrations of gas in the atmosphere. An automatic combustible gas alarm panel monitors six strategic locations on the plant. Detection of a combustible mixture of gas and air at any of these points sounds an alarm at the panel and on the station alarm system. Steps can then be taken immediately to shutdown and vent the plant to atmosphere.

Fire protection is provided by dry type chemical fire extinguishers, carbon dioxide fire extinguishers and fire hoses. The hose system is supplied with water from the field brackish water system and is maintained under pressure by a fire pump operated at the nearby gathering center. This pump can be remotely started by push button from the gas injection plant control room.

Building Layout. Compressors are housed in a steel frame brick clad structure approximately 154 ft long and 56 ft wide on two main levels. The ground floor houses the switchgear room which contains the terminal pipework to and from the turbines and compressors as well as the turbine compressor, filtering equipment and ducts. The turbines and compressors occupy part of the first floor, the remainder housing the control room, the nerve center of the plant, and offices. A double glazed partitioned wall separates the two sections which are held at an air pressure differential of 0.2 in. water

(*Continued on page 122*)

'M' Class

newest in AIR-BREAK switchgear . . .

The 'ENGLISH ELECTRIC' Class 'M' medium voltage circuit-breaker embodies the latest ideas in design and construction. It incorporates, for example, safety factors hitherto only associated with high voltage circuits. Easy to install, simple to operate and maintain, these circuit-breakers are totally enclosed under all service conditions and isolation is completed behind a closed door. The new range of time-controlled, direct-acting overcurrent tripping units give better performance and discrimination.

Send for Publication SG/352A to:
The ENGLISH ELECTRIC Company Limited, Switchgear Department,
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'ENGLISH ELECTRIC'
switchgear

31 MVA at 415 volts. ASTA Certificate No. 3789. Compact cubicles of uniform height for 800 and 1,600 amp breakers, 1,600 amp on 2′ 0″ centres. Unitised busbars for ease of uprating and extension; up to 3,000 amps available. Automatically operated shutters screen cable and busbar connections when the breaker is withdrawn.

THE ENGLISH ELECTRIC COMPANY LIMITED, MARCONI HOUSE, STRAND, LONDON, W.C.2

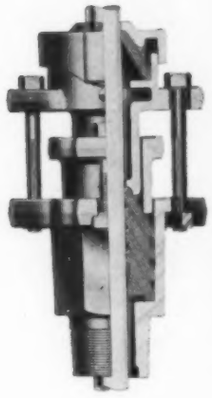
Offices and representatives throughout the world

SGL.43

HERCULES CONE PACKED STUFFING BOXES

Provide the ultimate in SAFETY, ECONOMY and EASE of operation

Hercules Stuffing Boxes — like all Hercules Products — are improved constantly to meet the changing needs of the industry and are available in three styles. They are used internationally and are available through supply houses, everywhere.

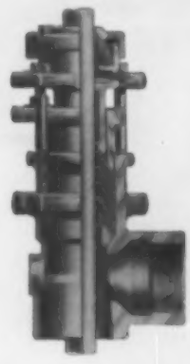


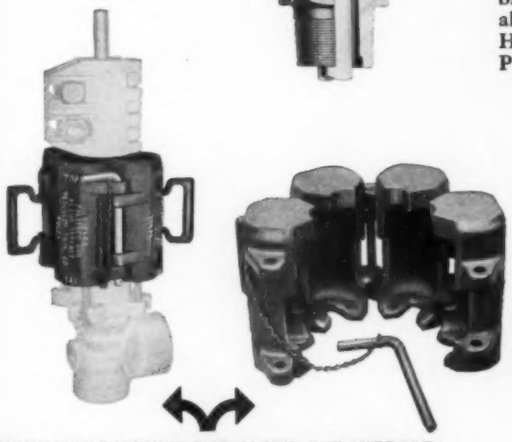
HERCULES REGULAR TYPE DUPLEX STUFFING BOX

More efficient operation with fine adjustment possible. Offers longer packing life due to ability of Packing and Glands to follow lateral movement of Polished Rod. Malleable iron construction prevents breakage if rods are accidentally dropped on Stuffing Box. Has male thread to screw into Pumping Tee.

HERCULES TEE TYPE DUPLEX STUFFING BOX

A combination Tee and Stuffing Box only 15" high. Eliminates one threaded connection between Stuffing Box and Tee. Full opening — allows rods to be run or pulled without removing Stuffing Box body. Has female thread to screw directly onto tubing.

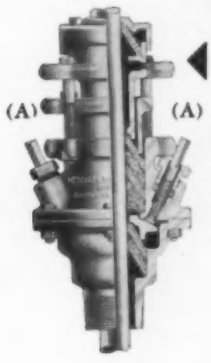




HERCULES POLISHED ROD CLAMP-OFF SUPPORT

Used with Hercules Regular and Tee Type Stuffing Boxes to *prevent accidents* or personal injuries while clamping off. Manufactured from high tensile aluminum alloy, will safely support 30,000 lbs. weight.

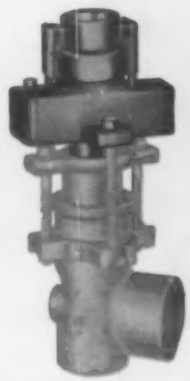
HERCULES TYPE DP (Double Packed)



Duplex Stuffing Box for use on high pressure or intermittently flowing wells. Allows Main (upper) Packing to be safely and easily replaced while well is under pressure. The two compression bolts (A) are turned clockwise until the lower Packing seals off. The Main Packing can then be removed and replaced.

HERCULES OIL RESERVOIR GLAND

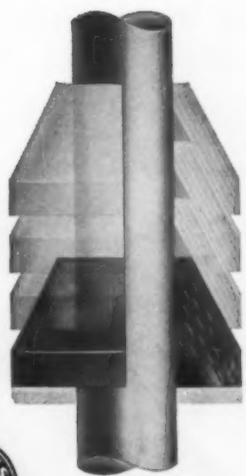
All Hercules Stuffing Boxes may be equipped with *Oil Reservoir Upper Gland* on *problem* wells which pump off and burn packing. The polished rod runs through the Reservoir, and is cooled and lubricated by its fluid.



For Best Results in Hercules Stuffing Boxes, use only

HERCULES CONE-SHAPED PACKING RINGS

Each set of Hercules Cone-Shaped Packing Rings now include the NEW, SOLID Split Bottom Cone Packing Ring. This new solid ring provides greater contact with the polished rod and a more substantial base for the upper Packing Rings, resulting in *longer* packing life and superior performance. A complete set now consists of three *regular* and one new split *Bottom Cone* Ring.



THERE'S A TYPE SPLIT CONE PACKING RING FOR EVERY REQUIREMENT:

Hercules Split Cone Packing Rings come in four grades: SOFT, HARD, SPECIAL LUBRICATED and HEAVY DUTY. SOFT Rings are always used with bronze liners or with steel polished rods in wells which are not always pumping fluid. HARD Rings are recommended for steel polished rods only, and where fluid is constantly being pumped. SPECIAL LUBRICATED Rings are recommended for problem wells which pump off persistently. When well is pumped dry, the rings lubricate the polished rod and prevent the packing from burning until fluid is again present. HEAVY DUTY Rings are recommended for problem wells. Properly adjusted, they give phenomenal life.

ACCEPT NO SUBSTITUTES

Ask for and accept only Hercules Cone-Shaped Packing Rings for use in all HERCULES Duplex Stuffing Boxes. All HERCULES Products are available through Your Supply Store.

Export Representative:
OILFIELD EQUIPMENT COMPANY, INC.
(T. E. Ward, Jr., Pres.)
90 West Street
New York 6, N. Y.

HERCULES TOOL COMPANY
Manufacturers of Oil Field Equipment
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Specialised OIL FIELD Transport

With a long experience in building the sort of trucks which the Oil Industry needs it is not surprising that Thornycrofts are well represented in all parts of the Oil World.

In Libya, Esso Standard are operating a fleet of "TRUSTY" chassis on special 16.00-20 sand tyres, including a number equipped as seen above with a Failing drilling rig for exploration.

Literature on all aspects of our products is available on request.

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THORNYCROFT HOUSE, SMITH SQUARE, LONDON, S.W.1, ENGLAND

BRANCHES AND AGENTS THROUGHOUT THE WORLD

World Petroleum Statistics

FREE WORLD SUPPLY AND DEMAND, CRUDE AND PRODUCTS, DECEMBER, 1959

(Thousands of barrels)

Source: USA Bureau of Mines, Division of Petroleum.

Country	CRUDE PETROLEUM: Production	Imports	Exports and reexports	Stock change, other demand, and loss	Total 1/ refinery input / Total 2/ refinery output	REFINED PRODUCTS: Imports	Exports and reexports	Apparent domestic demand (incl. bunkers) 3/	Bunkers-all flags (as reported)
NORTH AMERICA									
Canada	17,103	9,398	2,633	+592	23,662	5,348	68	4/30,990	
Mexico	8,070	-	-	-18	8,763	591	837	8,517	
United States (incl. Alaska)	222,969	31,879	258	+2,148	270,895	29,084	7,238	4/335,030	7,127
Subtotal	248,142	41,277	2,891	+2,722	303,320	35,023	8,143	374,537	
CENTRAL AMERICA AND CARIBBEAN									
Costa Rica	-	-	-	-	-	5/ 95	-	95	
Cuba	19	2,183	-	+23	2,119	5/366	-	2,485	
Dominican Republic	-	-	-	-	-	5/165	-	165	
El Salvador	-	-	-	-	-	5/144	-	144	
Guatemala	-	-	-	-	-	5/249	-	249	
Haiti	-	-	-	-	-	5/ 72	-	72	
Jamaica	-	-	-	-	-	219	-	219	
Nicaragua	-	-	-	-	-	5/ 90	-	90	
Panama, Canal Zone	-	-	-	-	-	847	162	685	306
Panama, Republic	-	-	-	-	-	5/175	-	175	
Puerto Rico	-	2,202	-	-262	2,508	143	1,812	839	
Subtotal	19	4,385	-	-239	4,627	2,565	1,974	5,218	
SOUTH AMERICA									
Argentina	4,221	3,912	-	+1,449	6,686	1,499	-	4/7,422	
Bolivia	283	-	101	+9	173	18	-	191	
Brazil	2,316	3,275	631	+145	4,815	2,040	-	6,855	
Chile	587	804	-	-53	853	5/595	-	1,448	
Colombia	4,800	-	2,260	+326	2,318	-	447	4/1,562	
Ecuador	221	250	-	+50	421	64	-	485	
Netherlands Antilles	-	22,961	-	+135	24,894	5/1,496	5/19,361	4/7,089	
Paraguay	-	-	-	-	-	5/ 61	-	61	
Peru	1,575	-	233	-62	1,423	438	543	1,318	28
Trinidad	3,590	2,896	-	+690	5,836	5/265	5/4,666	4/1,455	1,397
Uruguay	-	834	-	+46	788	150	-	938	
Venezuela	86,744	-	62,158	-379	27,588	5/ 47	23,010	4/6,575	1,740
Subtotal	106,337	34,332	65,383	+2,356	75,798	6,693	48,027	33,339	
WESTERN EUROPE									
Austria	1,427	350	565	+50	1,207	592	88	4/1,798	
Belgium and Luxembourg	-	4,898	-	+266	4,072	2,088	1,121	5,039	
Denmark	-	39	-	+30	9	3,360	5	3,364	158
Finland	-	574	-	-266	5/600	676	-	1,476	
France	1,128	19,962	7	+277	20,806	2,325	4,124	4/17,212	964
Germany, West	3,261	12,226	-	+1,020	14,467	3,530	1,968	4/16,991	5/1,069
Greece	-	567	-	-335	902	206	-	1,108	
Iceland	-	-	-	-	-	594	-	594	
Ireland	-	743	-	+50	693	218	-	911	
Italy	1,199	15,611	220	+93	16,569	1,220	3,904	4/11,797	1,198
Netherlands	1,036	6,683	-	-1,031	10,052	3,059	6,125	6,986	687
Norway	-	61	-	-13	74	2,305	-	2,379	
Portugal	-	977	-	+234	743	598	209	1,132	
Spain	-	2,847	-	+462	2,427	168	213	2,382	
Sweden	-	1,042	-	-719	1,761	8,465	98	4/6,384	5/247
Switzerland	-	-	-	-	-	1,988	-	1,988	
United Kingdom	53	24,463	-	-1,477	25,993	11,712	6,881	4/28,384	2,647
Yugoslavia	402	5/400	-	+25	777	5/ 70	5/ 46	801	
Subtotal	8,506	90,843	792	-1,094	101,152	43,116	26,782	110,946	
MIDDLE EAST									
Aden	-	3,477	-	-14	3,491	911	3,061	4/1,341	1,597
Bahrein	1,395	4,351	-	-104	5,925	170	5,284	924	435
Iran	29,088	-	18,534	-599	11,153	-	8,961	2,192	
Iraq	27,803	-	5/26,777	-	5/1,026	5/ 2	-	1,028	
Israel	77	5/763	-	-	840	5/977	-	1,817	
Jordan	-	-	-	-	-	5/ 96	-	96	
Kuwait	40,378	-	38,085	-2,431	4,724	-	2,466	5/2,258	1,719
Lebanon	-	471	-	-	471	5/ 22	-	493	
Neutral Zone	3,782	-	2,687	-35	5/1,130	-	5/400	730	
Qatar	4,785	-	5/4,706	-	5/ 17	-	-	17	
Saudi Arabia	37,499	-	33,227	-1,134	5,406	3	3,870	4/1,060	
Turkey	228	-	-	+47	5/181	5/1,360	-	1,541	
U.A.R., Syria	-	5/457	-	-	5/457	29	-	486	
Subtotal	144,975	9,519	124,018	-4,270	34,821	3,570	24,042	14,783	
AFRICA									
Algeria	2,873	-	2,814	+61	-	1,172	-	1,172	
Angola	36	5/ 50	-	-	86	115	-	201	
Belgian Congo	-	-	-	-	-	420	-	420	
Canary Islands	-	1,988	-	+144	2,287	197	1,209	1,275	413
Ethiopia	-	-	-	-	-	57	-	57	
States formerly in French Equatorial Africa	447	-	5/447	-	-	178	-	178	
French West Africa	-	-	-	-	-	339	-	339	
Ghana	-	-	-	-	-	305	-	305	
Kenya	-	-	-	-	-	587	94	493	
Liberia	-	-	-	-	-	5/ 32	-	32	
Madagascar	-	-	-	-	-	99	-	99	
Morocco	64	5/ 68	-	-	132	397	-	4/529	
Nigeria	-	-	-	-	-	461	-	461	
Rhodesia & Nyasaland	-	-	-	-	-	5/323	-	323	
Sudan	-	-	-	-	-	365	-	365	
Tanganyika	-	-	-	-	-	5/370	37	333	
Tunisia	-	-	-	-	-	293	-	4/293	
Uganda	-	-	-	-	-	5/ 98	15	83	
Union of South Africa	-	986	-	+149	837	1,626	235	2,228	
U.A.R., Egypt	1,913	5/917	1,030	-	5/1,800	5/730	5/ 12	2,518	
Subtotal	5,335	4,009	4,291	+354	5,142	8,164	1,602	11,704	
SOUTH ASIA, FAR EAST, AND OCEANIA									
Australia	-	6,233	-	-675	7,280	810	584	4/6,915	632
British Borneo	3,181	-	1,671	-	5/1,510	5/ 80	1,216	374	99
Burma	381	-	-	+160	221	5/ 65	-	286	
Ceylon	-	-	-	-	-	286	-	286	
India	884	5/3,443	-	-	5/3,707	2,583	186	6,104	
Indonesia	11,781	5/524	4,827	-	5/8,039	5/122	5/5,105	3,056	5/335
Japan	273	15,946	-	-347	15,566	1,800	795	16,571	
Korea, South	-	-	-	-	-	42	-	4/505	
Malaya and Singapore	-	-	-	-	-	3,432	1,692	1,740	1,255
Netherlands New Guinea	129	-	5/129	-	-	-	-	Insig.	
New Caledonia	-	-	-	-	-	5/ 34	-	34	
New Zealand	-	-	-	-	-	5/1,010	-	1,010	
Pakistan	212	-	-	-5	217	5/1,335	-	1,552	
Philippines	-	596	-	+64	532	5/958	-	1,490	5/ 65
Taiwan	1	364	-	-180	545	5/278	-	823	
Thailand	-	-	-	-	-	1,133	-	1,133	
Vietnam, South (incl. Cambodia)			-	-	-	5/461	-	461	
Subtotal	16,289	26,106	6,627	-983	37,617	14,329	9,678	42,240	
WORLD TOTAL EXCLUDING EASTERN EUROPE, U.S.S.R., & MAINLAND CHINA	529,536	210,411	204,002	-1,154	562,471	113,460	120,248	592,767	

1/ Estimate based on latest available data.
1/ Total input includes crude runs to stills plus runs of other unfinished oils, topped crude and natural gas liquids blended.
2/ Total output includes refined product output plus refinery fuel and loss; excludes liquefied petroleum gases sold directly for fuel and chemical uses from natural gasoline plants.
3/ Unless otherwise specified, data represent apparent domestic demand (including inland demand, refinery fuel and loss, and bunkers). Apparent domestic demand is derived from the components of refined product output, plus imports, minus exports, with no allowance for changes in stocks.
4/ Domestic demand as reported, including stock changes; also includes, where available, liquefied petroleum gases sold directly for fuel and chemical uses from natural gasoline plants.
5/ Apparent domestic demand is heavily influenced by refinery fuel and losses, bunker loadings, and stock changes.

First Half Earnings

Earnings of 58 oil companies increased 1.2% in the first half of 1960 to $1,501 million. In the same period the previous year these companies had reported net profit totaling $1,483 million.

Canadian companies generally reported good increases. Imperial Oil Ltd. was up $7 million, British-American Oil $5 million, Texaco Canada $747,000; Royalite $108,000 and Bailey Selburn $46,000. Hudson's Bay showed a drop of $5 million.

Only two Venezuela companies are reported. Creole earnings were down $15 million and Sinclair Venezuelan up $243,000.

Among the USA internationals Socony Mobil earnings were up $11 million; Gulf $14 million; Texaco $12 million and Standard of California $10 million. Standard of New Jersey was largely unchanged.

Earnings of the predominantly domestic USA companies were lower. Atlantic was down $439,000; Cities Service $233,000; Continental $568,000; Ohio Oil $823,000; Phillips $1,461,000; Sinclair $5 million; Standard of Indiana $14 million; Sun $1.9 million; Sunray Mid-Continent $2.2 million. Standard of Ohio increased its earnings $1.1 million and Union Oil $3 million.

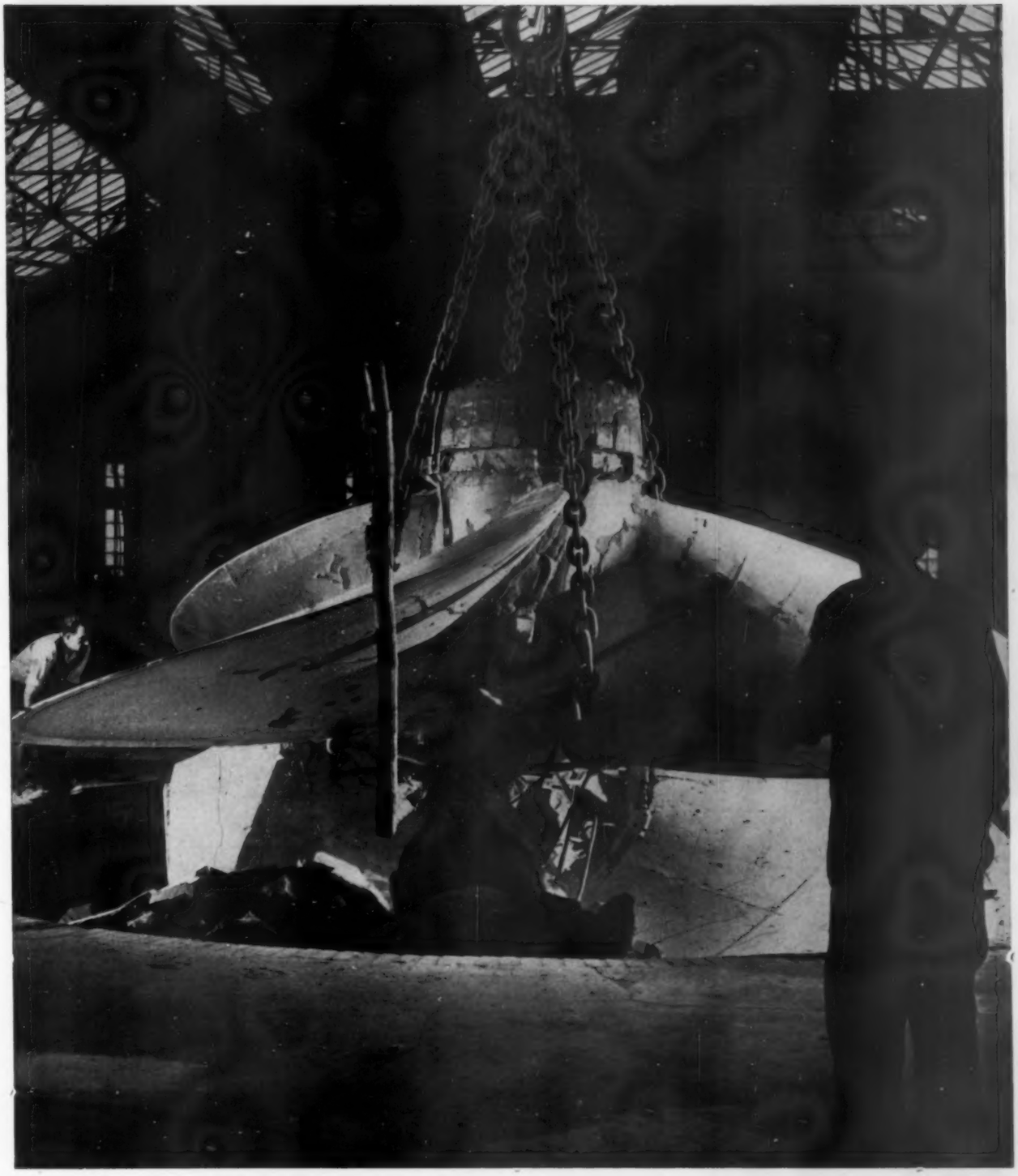
FIRST HALF 1960 OIL-COMPANY EARNINGS

(Six months total figures in thousands of dollars)

	1959 Six Months	1959 Per Share Common	1960 Six Months	1960 Per Share Common
Ambassador Oil	694	(a)$.19	180	(a)$.05
Amerada Petroleum	12,059	1.91	11,662	1.85
American Petrofina	(d)385	—	355	.05
Anderson Prichard	2,167	1.18	3,044	1.71
Atlantic Refining	16,917	1.80	17,356	1.85
Bailey Selburn	258*	1.80	212*	—
Barber Oil	(d)368	—	(d)368	—
Belco Petroleum	1,545	.29	1,429	(c).27
British American	13,730	.67	8,396	1.41
Champlin O & Ref.	3,362	.78	4,287	1.00
Cities Service	18,672	1.74	18,905	1.76
Colorado O & G	(d)313	—	1,034	.24
Columbian Carbon	4,026	2.49	(q)3,485	2.16
Commonwealth Oil Ref.	1,048	.22	(d)127	—
Continental Oil	28,493	1.35	29,160	1.38
Creole Petroleum	100,600	1.30	115,500	1.49
Crescent Petroleum	1,416	(a).71	1,382	(a).66
Crystal Oil & Land	92	.13	41	—
Dehli-Taylor Oil	2,150	.42	1,450	(c).28
Empire State Oil	816	.41	848	.43
Felmont Petroleum	1,508	.37	1,315	(c).33
Gulf Oil Corp.	156,096	1.56	141,814	(c)1.42
Hudson's Bay	614	.03	1,123	.06
Imperial Oil Ltd.	30,686	.97	23,334	.74
Kern County Land	7,272	1.68	7,742	1.79
Leonard Refineries	—	—	—	—
La. Land & Expl.	11,602	1.23	9,169	1.02
Monterey Oil	1,445**	(a).74	1,887**	(a)1.01
Newmont Mining	6,780	2.40	5,284	1.88
Ohio Oil Co.	17,733	(a)1.28	18,556	(a)1.41
Olin Oil & Gas Co.	1,575	.56	2,074	.73
Phillips Petroleum	(m)51,748	1.51	(m)53,209	1.55
Plymouth Oil Co.	43	.02	(m)2,184	.85
Quaker State	765	.93	1,004	1.22
Richfield Oil	13,988	(b)3.46	10,695	(b)2.65
Royalite Oil	188	.06	80	.03
Shamrock O & G	4,460**	1.28	4,786**	1.37
Shell Oil Co.	69,312	1.14	69,187	(g)1.14
Signal O & G Co.	7,604	.80	8,658	(c).91
Sinclair Oil Corp.	21,662	(e)1.40	26,600	(e)1.73
Sinclair Venezuelan	6,425	1.60	6,182	1.54
Skelly Oil	11,090	1.93	13,957	2.43
Socony Mobil Oil	83,400	(e)1.72	77,100	(e)1.59
South Penn Oil	1,898	1.20	1,796	1.14
Standard of Calif.	128,589	2.03	118,153	1.87
Standard of Indiana	64,887	(e)1.81	78,851	2.20
Standard of Kentucky	6,958	2.67	6,743	2.59
Standard Oil (N. J.)	315,000	1.45	315,000	1.47
Standard of Ohio	10,956	2.19	9,881	1.97
Sun Oil Co.	20,032	1.63	21,974	1.87
Sunray Mid.-Cont.	18,743	.95	20,948	(c)1.07
Texaco Inc.	177,342	2.93	164,961	2.78
Texaco Canada Ltd.	5,565	1.70	4,818	1.46
Texas Pacific C. & O.	3,968	1.02	3,642	.94
Tidewater Oil	18,277	1.16	18,633	(c)1.18
Union of Calif.	13,370	1.57	10,771	(c)1.26
Universal Cons. Oil	1,227	1.28	1,721	1.79
Wilcox Oil	446	(a)1.39	423	(a)1.35
	1,500,759		1,482,981	

*Five months to May 31. **Six months to May 31.

(a) On shares outstanding at close of period. (b) On average number of shares outstanding during year. (c) On shares now outstanding. (d) Net loss. (e) On average shares outstanding during period. (g) Adjusted to reflect stock split or stock dividend. (m) Includes nonrecurring income. (q) Excludes special charge of 30¢ per share in price-claim settlement for prior years.



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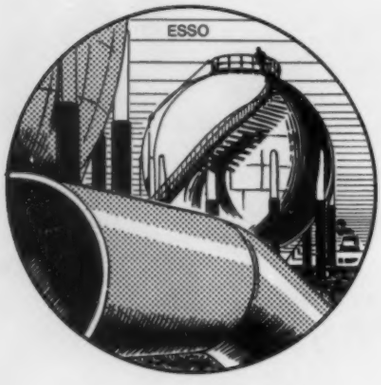

In addition, some 2000 technicians from the Werkspoor Construction Department are engaged in the erection of complete factories and installations, not only in the Botlek Area, but all over the world.

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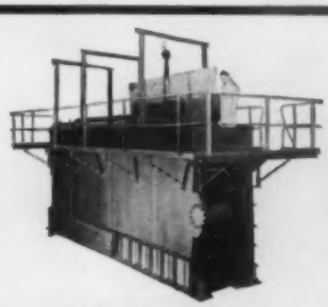
Bauduin

Fresh water from the sea

Pioneered in Great Britain by Richardsons, Westgarth & Co. Ltd., a new type flash evaporator which works continuously, with little attention and practically no maintenance and which needs only low-grade, sub-atmospheric steam for heating, has made it economically possible for towns on arid coast lines to obtain their fresh water from the sea itself. Evaporators of this type are now relieving water shortages in the Middle East.

R W G



Evaporating plant supplied to Procon (Great Britain) Ltd., for service in South America.

This Evaporator is, naturally, most economical in conjunction with steam power generation, or wherever waste heat is available, and, as we are builders of all types of boilers, steam turbines and alternators, we are particularly well able to design and carry out fully integrated schemes.

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Kuwait Oil Completes New Injection Plant

(Continued from page 113)

gauge. The space above the control room forms a second floor where pressurizing air fans and duct works, air conditioning equipment and air filtering equipment is situated. Constant temperature conditions are maintained in the control room and offices all year round.

Operation. The entire plant is controlled from the pressurized control room in which is located the turbine control duplex and graphic flow panels.

Signals from instruments located throughout the plant are received at this panel and automatically translated to show the positions of valves and operation of the main plant components by means of indicating lights. Manual positioning of the controls prior to start-up is effected on this panel, together with the start-up of the turbines and subsequent loading of the compressors. Manual shut-down can also be carried out.

During automatic operation, the panel will give the operator a complete picture of all functions of the plant and should any gas leakage, or other untoward event occur, warning and indicating alarms and lights show which component of the plant is being affected. If it is impossible to rectify the trouble manually, or if the operator is not available, the whole plant will shut down automatically and the gas system vent to the atmosphere. Start-up cannot then recur until the fault has been cleared.

The whole installation has been designed to give the maximum degree of automation and safety; enabling one man to start, load and operate the plant under normal conditions. This is done by the metering, recycle, pressure relief and venting systems which are pre-set from the panel for specific operating circumstances. These safeguard the plant during manual start-up and shut-down and, more important, control and safeguard the plant in operation. END

GROUP OPINIONS

Pipe Line Technologists, Inc. provides specialized professional engineering for every phase of oil, gas, chemical and products pipe line operation, from the initial market analysis and feasibility reports to the design, engineering, financial planning, supervision of construction and management of the completed project. The findings of these experienced, qualified, specialists in their field are coordinated by group action into conclusive reports and efficiently built and operated pipe lines.

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P. F. HAWKINS has become manager of an expanded operations division in Esso Standard's supply department. He succeeds **D. B. VOORHEES,** who became manager of the foreign division of Esso's traffic department.

DAVID H. FINNIE has been named to replace **WILLIAM TATGE** as alternate director in London for Mobil International Oil Co.'s interests in Iran. Replacing Finnie in New York as joint venture coordinator for Mobil's interests in Iraq is **RONALD F. DICK.** Mr. Tatge becomes director of relations for Mobil in Libya.

RAYMOND D. McGRANAHAN has been made president, Wilshire Oil Co. of Los Angeles, an independent marketer and refiner recently acquired by Gulf, he was administrative vice president and coordinator-transportation for Gulf. **EDWIN G. COOPMAN,** former president of Wilshire, continues as a board member, and will work with the company in an advisory capacity.

MARCEL A. BAUR, manager of Mobil Oil A.O. for the past six years, has retired after 35 years of service. He will be replaced at Mobil Oil A.O.'s headquarters in Dakar, West Africa, by **ROLAND M. RIEUTORT.** Mobil Oil A.O. markets throughout the French Community countries and independent French-speaking states of West Africa.

LEROY W. HOLM has been appointed supervisor of the secondary recovery section of the production engineering research division at the Pure Oil Co.'s research center at Crystal Lake, Ill. Mr. Holm joined Pure in 1946 and has been assigned to production engineering for the last four years. Prior to that, his work dealt with lubricating oil treating problems.

L. PHIL. GAGNON has been appointed general manager for Quebec of the Golden Eagle Refining Co., of Canada, Ltd., wholly owned subsidiary of Ultramar Co., Ltd. of London, fourth British oil company in size. Offices in Montreal have been opened at 1310 Greene Avenue. James Allan has been oppointed general manager of Golden Eagle for Newfoundland and has opened offices at 41-43 Churchill Square Building. Golden Eagle is now constructing a petroleum refinery in Newfoundland near St. John's and will start immediate construction of a large storage terminal in the Montreal area. Construction of other storage terminals will follow as Golden Eagle plans extensive marketing throughout all of Eastern Canada.

THOMAS E. FISKE, a senior attorney for Standard Oil Co. (Indiana), will represent the company in activities concerned with protection of the petroleum industry's established markets from the effects of gasoline tax evasion or unethical practices. He will also supervise other assignments of investigation and security.

W. L. HUNTER

W. L. (Luke) Hunter, who retired March 31, 1960, after 31 years with Hughes Tool Co., died July 4 in an Ardmore, Oklahoma, hospital. Death was due to injuries received in an automobile accident July 1 near Ardmore. Mr. Hunter joined Hughes in 1929 and served in many capacities, including district, division and region manager.

JAMES A. AHEARN

James A. Ahearn, executive vice president and director, Sinclair Refining Co., died July 11 at Englewood Hospital after a brief illness. He was 58 years old. A member of the General Committee, Division of Transportation of the American Petroleum Institute, Mr. Ahearn was active in industry affairs concerned with the transportation of crude oil and its products.

Specifically to meet jet fuel needs up to 80 tons and more, this powerful White 3000T-OH delivers 10,000-gallon payload. Two of them do an entire refueling job in just 20 minutes.

Dual axles forward provide ideal weight distribution on this White 3046-OH for payloads from 65,000 to 80,000 pounds. Answers the need for a single-tired tandem front, dual-rear, 8-tired truck.

Pumps 1100 gallons per minute. Only 90" high, this White 3026-OHS has single steering axle, with dual-tired differential wheel. Smaller wheelhouse permits shorter tank and wheelbase, improving maneuverability.

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AS434

Artistic Design Produces Good Process Performance

(Continued from page 84)

BASIS: 4 INCH O.D. ROUND CAP
5.36 SQ. IN. SLOT AREA

	CAST IRON	STAINLESS STEEL	PERCENT INCREASE
RISER AREA, SQ. IN.	3.14	5.25	68
ANNULAR AREA SQ. IN.	4.71	5.85	24

Fig. 9—Stainless steel and proper artistic design have contributed to better fluid flow through a bubble cap assembly.

conditions. Thus there was an evolution in which the "rim and center" downflow pattern using circular pipes was replaced by a plate type downflow section having a straight overflow weir in the form of a chord with sufficient length to regulate the maximum height of liquid overflow. This design, known as the single cross flow pattern, is also shown in Fig. 8. For increased diameters and increased liquid-vapor ratios due to higher pressure operation, the single cross flow design also had its limitations because of liquid gradient and weir length problems, hence the development of the so-called double cross flow design as shown also in Fig. 8, undoubtedly the most widely used design today. For unusually large towers where the simple form of double cross flow cannot be used, certain modifications have evolved to resolve the more serious liquid gradient problems. Space does not permit detailing further these many variations.

The final problem in bubble cap tray design is the mechanical one. For large towers which can be shipped as fabricated items, general practice is to build trays in sections which can be passed through a manway and assembled in the tower after field erection. The common material for tray support elements, tray sections, risers and bubble caps in early installations was cast iron, principally because of its good corrosion-resistant properties, its relatively low cost and its general availability. However, cast iron also presents many problems, and achieving an easily assembled, level, liquid-tight, cast iron bubble cap deck of large diameter is a near miracle.

The solution has come with the employment of stainless steel for all deck parts, including well designed light-weight trusses as support members, thin sheets for deck plates, and formed bubble caps. Decreased weight of all parts made handling easier. The lack of rigidity of stainless steel sheets made possible a new degree of tightness at the joints. However, the most startling gain is in the geometry of the single bubble cap assembly as shown in Fig. 9.

The comparison of the old cast iron and the new stainless steel design is brought out by reference to certain critical dimensions. Starting with the same outside diameter of bubble cap at the bottom of the slots; i.e., the same slot area, the differences are shown in the table in Fig. 9. In effect, this change in materials of construction has provided useful space for fluid flow instead of non-useful metal thicknesses.

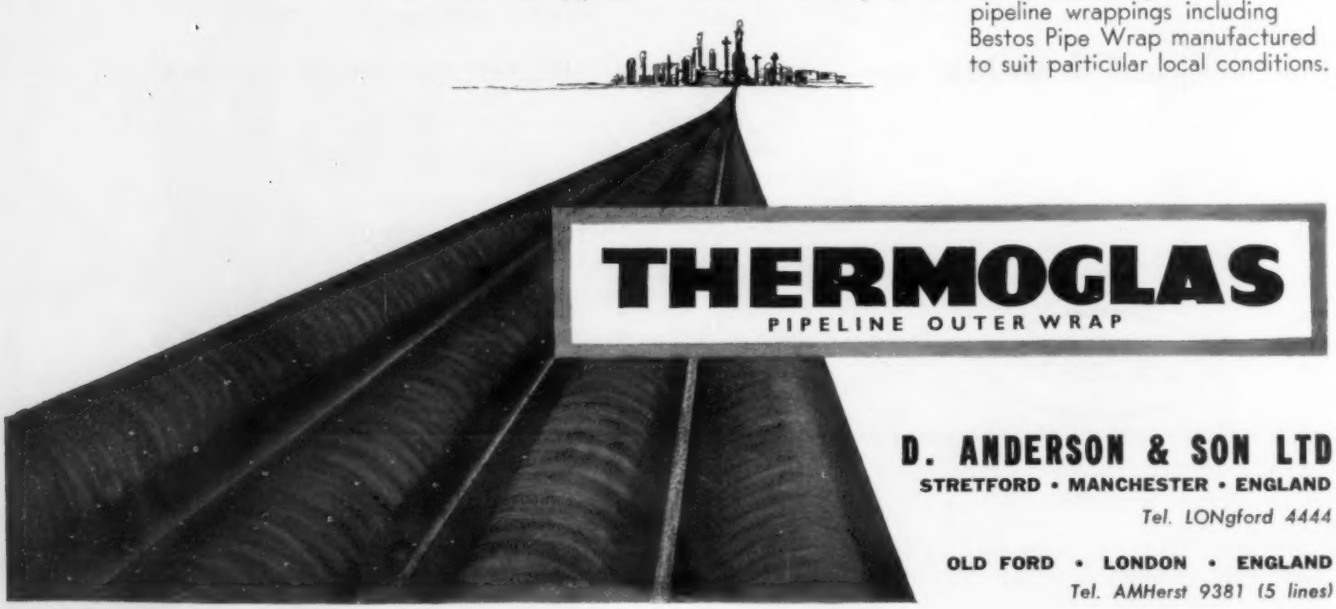
The final product of chemical or petroleum process design is the complete plant in which (1) the process units, (2) the service units, (3) the buildings for office use, for plant maintenance, for warehouse supplies and for laboratory use, (4) the areas for storage of raw materials, intermediate and final products, (5) the facilities for product shipment and (6) the roads and pipelines are all combined to form an integrated harmonious pattern. Only by visionary planning can this result be obtained.

The manager of one of the largest and most complex oil refineries in Europe once told a group of visitors that the planning and layout of his refinery was such that no finished product had to be moved more than *a few hundred* feet from the final process step, storage or packaging facility to the point of shipment, be it a tanker, a river barge, a railway car or a truck. This is the ultimate in good design.

An excellent example of this is shown in the accompanying photograph which is the largest single butadiene producing plant ever built. We see geometry everywhere—in the process units, in the storage areas and in the plant layout plan. The performance of this plant was unusually successful and contributed greatly to the war effort. The principles outlined in this article were followed in great detail for the project and the approach was a major contribution to its excellent record. END

Reflection on protection

The basis of Thermoglas protection is a reinforced glass fibre tissue impregnated for use with either coal tar enamels or asphaltic bitumen. Thermoglas pipeline Outer Wrap has met fully the requirements of major contracts both at home and overseas with such characteristics as strong adhesion and high tensile strength. In widths up to 36 inches to suit pipeline diameters, Thermoglas is one of a wide range of pipeline wrappings including Bestos Pipe Wrap manufactured to suit particular local conditions.



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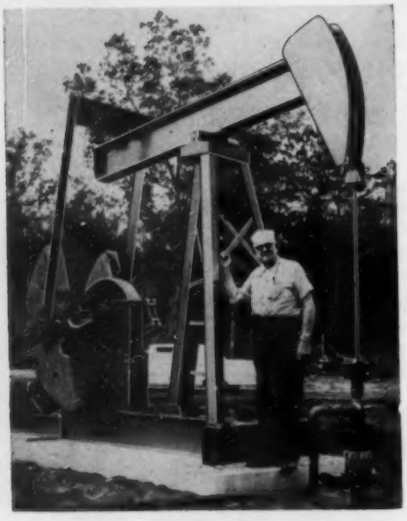

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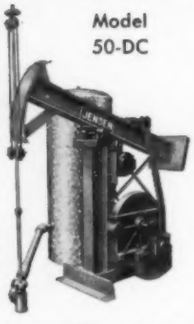
Model 50-DC



Compare this product chart on the 50-DC with comparable makes.

CYL. I.D.	DROP PIPE SIZE	GALS. PER HOUR	¾ H.P. MOTOR 20-40 PRESS.	¾ H.P. MOTOR OPEN DISC.	1 H.P. MOTOR 20-40 PRESS.	1 H.P. MOTOR OPEN DISC.
1¾"	2"	105	900'	1050'	1310'	1400'
1⅞"	2"	190	475'	565'	660'	750'
2⅛"	2½"	415	260'	350'	380'	470'
3"	3½"	595	130'	220'	285'	295'

JENSEN JACKS

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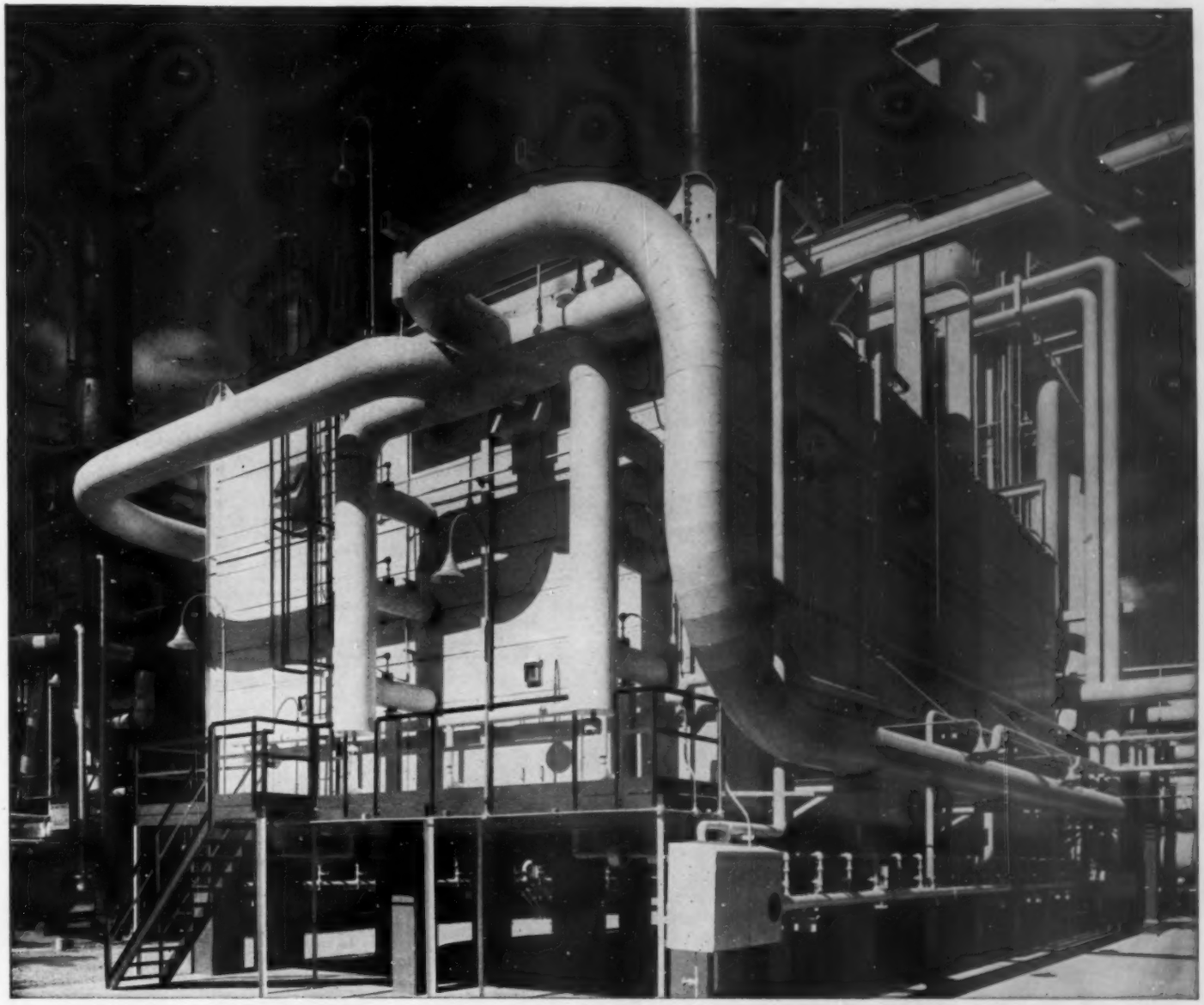

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Petrochemical Raw Materials for Epoxy Resins

(Continued from page 78)

20 C is only 0.36%). The organic reactant is fed in slight excess (0.3-1.0%) above stoichiometric quantity. Reaction temperature is 25-35 C and pH is held at 0.5-2. Typical glycerol dichlorhydrin yield is 92%.[15] Representative product distribution is 70% 2, 3 dichloro-propan-1-o1 and 30% 1, 3-dichloropan-2-o1.[16] Both compounds are convertible to either epichlorohydrin or glycerine.

The final step in epichlorohydrin synthesis (Equation 3c) involves the alkaline dehydrohalogenation of glycerol dichlorohydrin. Feed dichlorohydrin is in highly dilute (about 4.6 wt-%) aqueous solution, as it is obtained from its synthesis. This crude product is fed to an enrichment still. Top product is 5-15 wt-% aqueous dichlorohydrin (which forms a 23% azeotrope with water at atmospheric pressure and 99 C).

The bottom portion, containing residual dichlorohydrin, is treated with 15 wt-% lime at 80-90 C during a residence time of four minutes. The resulting epichlorohydrin is taken to a stream stripping column in which epichlorohydrin is taken overhead in about 95% purity. A subsequent distillation permits essentially complete removal of residual water from epichlorohydrin. Yield of epichlorohydrin exceeds 95% of theory.

This approach to epichlorohydrin[17] production is one method by which the final conversion of dichlorohydrin is integrated with manufacture of glycerine. Thus dichlorohydrin concentration in the first fractionation step may be combined with part of the epichlorohydrin and the mixture converted to glycerine by caustic hydrolysis. The approach avoids the difficult recovery of glycerine from large amounts of sodium and calcium chlorides which would otherwise be necessary. Other such combination schemes have been described.

Obviously, the entire recovered dichlorohydrin may be converted to epichlorohydrin by reaction with lime. However, as we have seen above, epichlorohydrin is today only a secondary co-product of glycerine manufacture and its production is therefore integrated into the main process flow of the glycerine plant. END

BIBLIOGRAPHY

[1] Kingsley, G. F. et al. Epoxy Resins. Graduate School of Business Administration, Harvard University. July 1959.
[2] Willner, J. R. *Chem. and Eng. N.*, September 21, 1959, 32-33.
[3] Kingsley, et al. quoted in *Chem. Eng*, Nov. 16, 1959, 113-4.
[4] Anon. *Chem. Wk*, Oct. 26, 1959, 22-23.
[5] Anon. *Oil Paint and Drug Reporter*, Nov. 9, 1959.
[6] Anon. *Chem. Week*, August 15, 1959, pp. 75 ff.
[7] Bender, H. L. and Conte, L. B. U. S. 2,858,342 to Union Carbide Corp., October 28, 1958.
[8] Williamson, G. T. U. S. 2,730,552 to Shell Development Co, Jan. 10, 1956.
[9] Stoesser, W. C. and Sommerfield, E. H. U. S. 2,623,908 to Dow Chemical Co, Dec. 30, 1952.
[10] Williamson, G. T. U. S. 2,775,620 to Shell Development Co., Dec. 25, 1956.
[11] Perkins, R. P. U. S. 2,191,831 to Dow Chemical Co, Feb. 27, 1940.
[12] Forni, A. *La Chimica e l'industria* XL, 9 (1958), pp. 727-731.
[13] Williams, *Trans. A. I. Ch. E. Vol.* 37, 176 (1941).
[14] Van Dijk, C. P. et al. U. S. 2,763,699 to Shell Development Co, Sept. 18, 1956.
[15] Smith, W. C. et al. U. S. 2,614,122 to Shell Development Co, July 26, 1955.
[16] dela Mare, P. and Pritchard, J. *J. Chem. Soc*, 1954, 3910-5.
[17] Thomas, R. M. et al. U. S. 2,858,345 to Olin Mathieson Chemical Corp, Oct. 28, 1958.

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IDECO Appointment

The appointment of Robert C. Hamilton as treasurer and controller of Ideco Division of Dresser Industries, Inc., has been announced. Mr. Hamilton comes to Ideco from Texaco, Inc., prior to his association with Texaco, Mr. Hamilton was assistant controller of Seaboard Oil Co., Dallas, Texas.

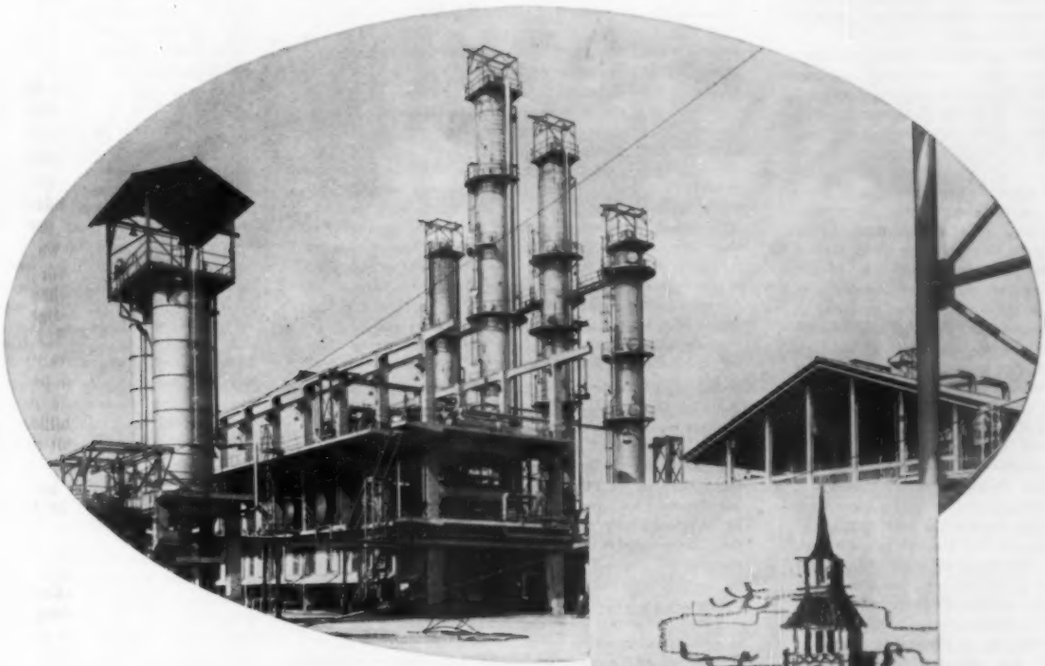
R. C. Hamilton

E. Rettig

Grove Names Rettig

Grove Valve and Regulator Co., Oakland, California, has named its first full time sales and service representative for South America. He is Ernest H. Rettig, formerly with El Paso Natural Gas Co., El Paso, Texas, where he served as a technical representative in the project engineering and pipeline construction departments.

Mr. Rettig will be responsible for sales of Grove's complete line of valves in South America. He will be headquartered in Houston, but will make frequent and extended sales trips to South American countries.



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LETTERS TO THE EDITOR

The Tanker Question

Dear Editor:

In your June, 1960 issue you published an editorial entitled "A Self-Defeating Proposal" in which you set forth a premise about the recent efforts of this organization, Committee of American Tanker Owners, Inc., which I believe to be false and properly should be corrected for the record.

As you may know, this committee has in membership 13 independent American corporations that own and operate that number of modern supertankers built at the urging of the United States Government with borrowed money guaranteed by the government and private capital invested by the owners of these corporations.

Less than four years ago our government—in view of the tanker shortage at the time of the Suez crisis and the rapid obsolescence of the American tanker fleet—instituted a program to encourage the building of American tankers by guaranteeing 87½% of the mortgages for the building of a group of vessels. Under this program private industry invested millions of its capital and constructed, as the nucleus of the merchant marine of tomorrow, a fleet of modern supertankers. These tankers were built to carry our essential and ever increasing oil imports. No provision, however, was made to ensure the operators of these vessels be protected—in the event of a tanker depression such as has existed for the past 2½ years—against cut-rate competition by cut-rate operators of low-wage, tax-free foreign ships.

The members of this organization recently have been undertaking, both through legislation and appeals to certain executive agencies of the federal government, to find a way to solve the crisis in which they find themselves—a crisis that under existing conditions can only lead to the economic failure of their enterprises, to an unnecessary burden being placed upon American taxpayers and, finally, to a disturbing and unnecessary weakening of one phase of our national defense.

Specifically, your editorial refers to one part of the CATO effort as a "new attempt . . . to find a means of escaping the law of supply and demand."

The fact is that the modern tanker fleet represented in the CATO member-ownership is an integral part of our defense needs and that the objectives sought by the CATO members in this instance are no different than those that have been sought and obtained by other industries in the past. Where national defense considerations are involved, it has been a long standing policy of our government to offer protection to industry. I am sure you are familiar with the fact that the domestic producers of petroleum have obtained such assistance, for approximately the same reasons that we are seeking it—and also in the name of national defense.

While it is the policy of our country to rely for its national defense requirements on the so-called "Panhonlib" flag vessels, it is certainly not our policy to rely exclusively on such foreign flag ships to the detriment of American flag vessels. No one would seriously question the need for American flag tankers. This being so, one must face up to the reality that they can exist only if there were sufficient cargoes for their full employment. This does not mean that *no less than 50%* of our imports must be carried on American flag tankers. Our objective is to get a fair share of oil imports but not more than required to provide employment for these tankers whenever they are available at reasonable rates and conditions.

Hence, the extra cost to the consumer, if indeed there be any at all, for the protection of United States tankers would be negligible considering that imported oil is a small percentage of the total United States consumption and that only a small share of this (perhaps 10% of oil imports) would be required to give employment to American tankers. These tankers would be chartered only when available and only at reasonable rates as determined by the Maritime Administration, whereas tanker freights for foreign ships may be in the future higher than the Maritime Administration rates, as they have been at times in the past.

The anonymous authorities who estimated the cost of this program to be in excess of $100 million yearly are, to say the least, grossly miscalculating its effects.

Presently the Government is committed to guaranteeing $200 million in loans that have been made to construct the tankers owned and operated by the CATO members.

Through legislation, we are attempting to obtain the government's cooperation in meeting the payments due on these obligations prior to default in order that this vital tanker fleet may be kept in operation against the time of emergency need. Through other approaches, as noted above, we are seeking to protect these American flag tankers by obtaining a percentage of imported cargo up to 50% in order that they can operate with sufficient profit to repay the government and thus conserve tax dollars.

It is also important to remember that many of the older tankers now operating have been in service for many years and their obsolescence within the next few years will lead to a serious reduction in this branch of our merchant marine.

The overage American tankers—70% of our fleet—are not being replaced because due to the tanker depression financing is unavailable. Even if they could survive economically during this tanker depression, their physical life is at end. Where bankruptcy does not, age soon will condemn them to be used for scrap. If we foolhardily permit the destruction of the American tanker fleet, we will inevitably again face a costly and gigantic crash program such as was necessary in World War II when we had to construct more than 54 million deadweight tons of merchant ships at a staggering cost of $12.5 billion. Had we prior to that war ensured—as we wisely now have begun under the aforementioned program—a long-range ship construction project, the American taxpayers would have saved some $8.5 billion. If we repeat the errors of yesteryears and permit the weakening and destruction of America's lifeline, the history this nation will be short indeed. It is imperative for our country's security that we ensure an American Merchant Marine second to none.

Finally, as businessmen, the members of CATO are not seeking any assistance that has not been granted in similar situations affecting other defense enterprises; nor are they seeking any special subsidy, other than an opportunity to pay in full the obligations incident to the construction of the tankers and thus to insure their continued operation whatever condition may prevail in the uncertain future.

Charles E. Potter
Executive Director
Committee of American Tanker Owners, Inc.

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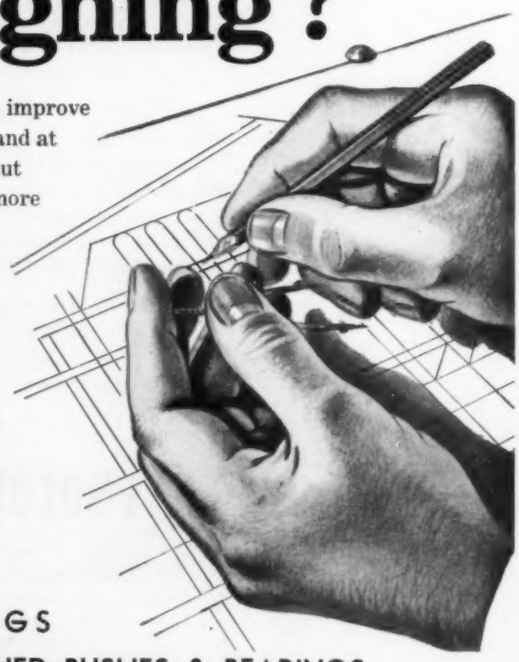

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Russian Oil Competition

(*Continued from page 53*)

Portugal, Tunisia, and Yugoslavia (Romania refused to supply Yugoslavia with any more oil in 1958). Sweden has a three-year understanding for delivery of 36,000 b/d of crude and products in 1960 and 40,000 b/d in 1961.

In India the Soviet push into oil has been especially strong and varied. Russians and Romanians are exploring with the government's Oil and Natural Gas Commission. The Soviets are helping the government build a 40,000 b/d refinery at Barauni and the Romanians are giving technical and financial assistance on a 15,000 b/d plant at Noomatie. When the Soviet offer to supply crude and products came it was at a particularly sensitive time. The oil companies had carried on discussions with the government for years and had twice given two price concessions. When the Soviets offered crude at 10% to 20% below world prices, the government circulated a request to the three principal refining companies to take and refine the crude. The Russian offer was especially attractive to India in that it called for payment in rupees, instead of dollars. An agreement to buy 1,500,000 tons of products (about 11,250,000 barrels) was concluded by the government with the Russians after the companies refused to refine the Russian crude. While the government said it did not intend to take any action against the companies such as Cuba did, the head of the Oil and Gas Commission, said the 25-year contracts under which the refiners were operating were "not good agreements." The companies thereafter did make a concession on their crude prices. Shell came down 7.5% and Stanvac announced it would be "fully competitive" with reports circulating that they would reduce their prices by 15%. It was unfortunate timing, for it looked like the companies reduced their crude prices only because of Russian pressure. Actually, they had intended to reduce their prices some time before, according to company spokesmen.

India has signed an agreement calling for the import of about 4,300 b/d of kerosine and 1,500 b/d of diesel oil during the first 12 months after shipments begin. The first shipment is scheduled to arrive in August, 1960 when a tanker will bring 11,000 tons of kerosine and diesel oil, according to the government-owned oil company in India. The crude was offered at a discount on the f.o.b. Black Sea price, which works out to about 25 cents per barrel reduction on the laid down price in India. The oil companies have countered with a price reduction on their own crude, as previously stated.

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The Ruston skid-mounted 'TA' gas turbine is the lightest long-life power package ever!

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Signal Moves

Signal Oil and Gas Company's home office has been moved to its new 16-story building at 1010 Wilshire Boulevard, Los Angeles.

Appoints Foreign Representatives

Salt Water Control, Inc. Houston, has appointed rental and service representatives in Canada and South America. Handling the line of SWACO D-Gassers in Canada is Native Solids Controllers, Ltd., Calgary and Edmonton. Petroleum engineer in Edmonton is Mickey D. Parker.

SWACO sales and service in Colombia are now being handled by Magnet Cove Barium Corp. through Sudamericana de Perforaciones y Servicios C. A. (SUPERSER). Other South American sales and service points include Venezuela and Trinidad.

Ultrasonic Inspection

Formation of a new oil industry inspection company was announced in Houston recently by Welex President, Ray O. Shaffer. The new company, International Inspection, Inc. or Triple-Eye, specializes in ultrasonic inspection of oil field tubular goods and refinery and petrochemical plant piping and vessels for corrosion. Triple-Eye is a subsidiary of Welex, Inc., wireline service company with headquarters in Fort Worth, Texas. Welex is a subsidiary of Halliburton Co., Duncan, Okla.

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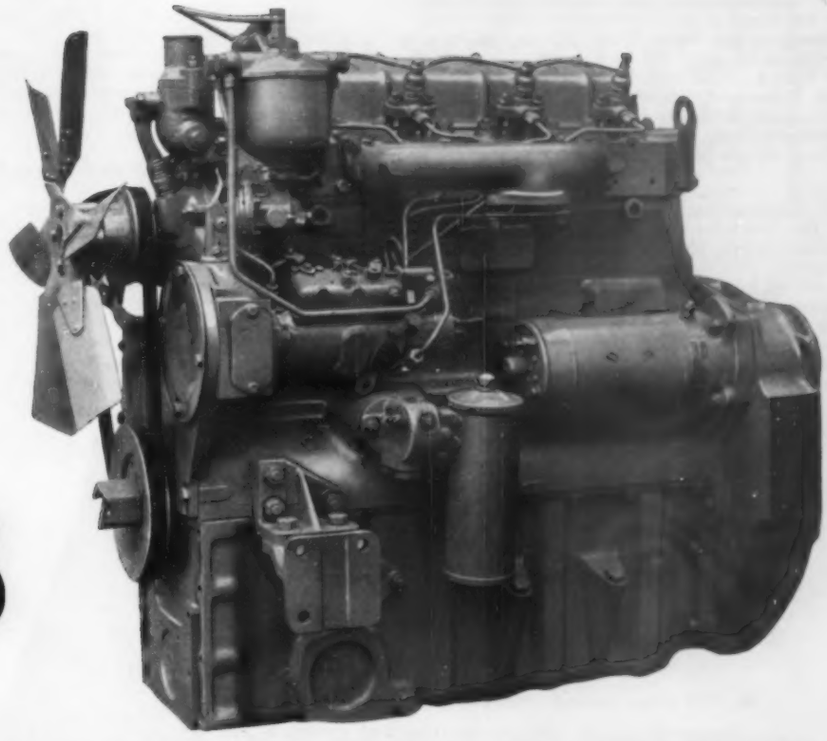

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TYPE	No. of Cyls.	Bore (ins.)	Stroke (ins.)	Swept Volume (cu. ins.)	Rating	R.P.M./GROSS B.H.P.							
						1000	1200	1500	1800	2000	2400	3000	3600
Four 99(1)	4	3	3½	99	A	10.5	13.5	18	22	24.5	29	34	—
					B	12	15	20	24.5	27	32	38	—
					C	12	15.5	20.5	25	27	33	39	43
P3/144(1)	3	3½	5	144	A	16.5	20.5	25.5	30	33	—	—	—
					B	18.5	22.5	28	33	36	—	—	—
					C	18.5	23	29	34	37	42	—	—
Four 203(1)	4	3.6	5	203	A	25	30	38	44	47	—	—	—
					B	27.5	33	41	48	52	—	—	—
					C	28	34	43	50	54	60	—	—
Four 270(1)	4	4½	4½	270	A	33	39	47	53	57	—	—	—
					B	36	43	52	58	62	—	—	—
P6(1)	6	3½	5	288	A	34	41	51	60	65	—	—	—
					B	37	45	56	66	72	—	—	—
					C	38	46	58	69	75	83	—	—
R6(1)	6	4	4½	340	A	38	46	58	67	69	—	—	—
					B	41	51	64	74	76	—	—	—
					C	44	54	68	81	89	102	—	—
S6(1)	6	4½	5	450	A	49	62	80	96	105	—	—	—
					B	54	68	88	106	115	—	—	—
					C	56	70	90	108	119	—	—	—

REMARKS

A. Denotes continuous rating to BS 649: 1958 conditions (85°F. and 29·5 hg). For every 10° above 85°F. this rating should be reduced by 2% and for every 1000 ft. above 500 ft. altitude the rating should be reduced by 3½%.
B. Denotes one hour rating to BS 649: 1958 conditions. See notes above re de-rating.
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PESA Elects

The Board of the Petroleum Equipment Suppliers Association has elected Elliott Johnson and John G. Seiler as president and vice president, respectively, of P.E.S.A. at the annual meeting in Banff, Canada. Mr. Johnson of Houston, Texas, is vice president-finance and general counsel of the Schlumberger Well Surveying Corp. and Mr. Seiler, is president of Tube Turns, division of the Chemetron Corp.

New PGAC Perforator

Pan Geo Atlas Corp. recently introduced to field service its new "Bull-Jet" shaped charge for use in 3⅛" o.d. steel case retrievable guns. Test-fired under 1,500 psi fluid pressure at 180°F., with stand-offs or clearance of ½", 1" and 2", and with all targets and lab flow data complying with the proposed API standards for perforator evaluation, PGAC's new Bull-Jet charges produced outstanding records in the tests by the independent lab.

Centrifugal Pipeline Compressors

Clark Bros. Co., one of the Dresser Industries, has published Bulletin 187 which details mechanical and hydraulic design considerations for two stage centrifugal pipeline compressors. Copies of Bulletin 187 complete with charts, diagrams and important calculating formulae can be obtained by writing to Clark Bros. Co., Olean, New York.

Lo-Torq Valves With Flanged-Ends

Versatile Lo-Torq Plug Valves designed by Halliburton Co., Duncan, Okla., for service work, are now available in a variety of sizes, equipped with flanged-ends in addition to the standard threaded Lo-Torq valves on the market for over a year.

The plug and inserts which are subject to the most wear may be easily replaced without removing the valve from the manifold or line. Since there is no necessity for matching parts, the need for returning valves to the factory for repair is eliminated.

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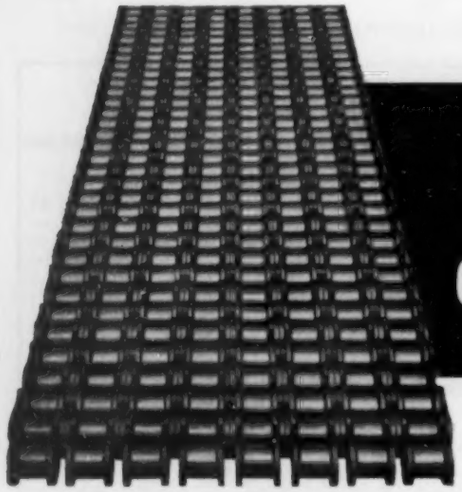

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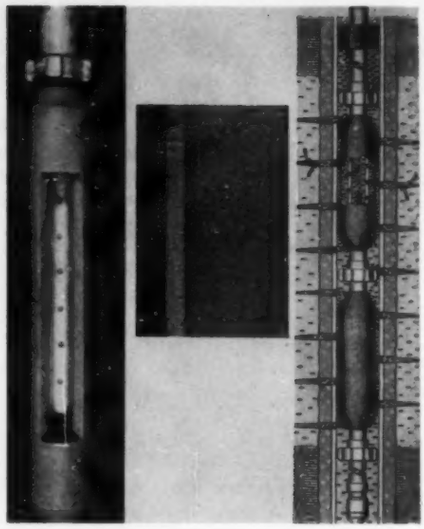

New Sand Screen Uses Sand Face

A new development in sand control methods—a screen with outer area covered with sand—is available now from Halliburton Co., Duncan, Okla. The preformed screen is essentially an outer cylinder of sand, bonded together and held in place by thermoset resin, around standard perforated or slotted tubing. It employs a sand face as the direct screening medium, without an outer covering of metal.

Because of this greater exposed surface flow area —several times as much as conventional liners— screening of formation sand is diffused over the screen's entire surface, rather than concentrating at restricted points of entry.

Underwater Oil Storage

An experimental underwater storage system has been installed in the Gulf of Mexico near St. Petersburg, Florida. The facility consists of a series of interconnected nylon-reinforced rubber tanks which could be filled or emptied by tankers.

The saucer-like tanks are semi-cylindrical in shape and, when filled, measure 14 to 23 ft in cross section. They are made of multi-ply nylon, coated with synthetic rubber.

UOP Reports Half-Year Net

Universal Oil Products Co. has reported net earnings of $814,121 for the six months ended June 30 from income of $29,914,709. Per share earnings were 28 cents for the period. Half year earnings are "currently in line with earlier forecasts and your management fully expects per-share earnings for 1960 to at least equal those for 1959," shareholders were advised. Earnings last year were $1.12 per share.

The report pointed out that substantial expenditures for research and development have been increased and will continue at a high level, adding "Although this reduces current income, the results of this research and development will have a beneficial effect on future income."

Quarterly earnings are not indicative of full-year results because UOP's fourth quarter earnings are historically the highest, the company reported. Many licensees of its petroleum refining processes make annual payments in the fourth quarter, the company commented, and earnings of its construction subsidiary, Procon Inc., vary widely because income is recorded only when projects are completed.

Varel Plant In Algeria

D. W. Varel, president Varel Manufacturing Co. of Dallas has announced a $100,000 plant in Rouiba, Algeria for the manufacture of rock bits to be known as Varel Afrique. Mr. Varel is the first American manufacturer to be granted a permit to operate in this area.

Garrett Promotions

Fred L. Magoon, Jr., has been promoted to manager of engineering and Bolling A. Abercrombie has been named manager of production planning and evaluation for Garrett Oil Tools, Longview, Texas.

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ADVERTISERS' INDEX

(Advertising Agencies in Italics)

American Iron & Machine Works Co., Subsidiary American Machine & Foundry Co. Cover III
Lowe Runkle Company

American Machine & Foundry Co., American Iron & Machine Works Co. Div. Cover III
Lowe Runkle Company

D. Anderson & Son Ltd. 126
John Newton (Publicity) Ltd.

Associated Electrical Industries Ltd. 125
Technical & General Advertising Agency, Ltd.

Beckman Instruments, Inc. 27
Charles Bowes Advertising, Inc.

Birkett, Billington & Newton Ltd. 132
S. C. Peacock Ltd.

British Oxygen Gases Ltd. 102
F. C. Pritchard Wood & Partners Ltd.

The British Petroleum Co., Ltd. 99
S. H. Benson Ltd.

Burton Delingpole & Co., Ltd. 95
S. H. Wright & Co., Ltd.

Byron Jackson Tools, Inc. (A Subsidiary of Borg-Warner Corp.) 17
John Ramsey Company

California Texas Oil Company, Ltd. 33
Gaynor & Ducas, Inc.

Cameron Iron Works, Inc. 20
Boone & Cummings

Cape Asbestos Company, Ltd. 66-67
Taylor Advertising, Ltd.

Chicago Bridge & Iron Company 7
Russell T. Gray, Inc.

Chiksan Company 28
The McCarty Company

Compagnie Generale De Geophysique 35
OEDIP

Cummins Engine Company, Inc. 79
Gotham-Vladimir Advertising, Inc.

Davison Chemical Co., Div. of W. R. Grace & Co. 37
Van Sant Dugdale & Co., Inc.

G. Dikkers & Co. N. V. 11

Dowell, Div. of Dow Chemical Co. Cover IV
Rives, Dyke & Company

Dresser Industries, Inc. 24-25
Persons Advertising, Inc.

English Electric Company, Ltd. 114
The Technical Advertising Service

Ethyl Corporation 1
Reach, McClinton & Co., Inc.

Foster Wheeler Corporation 21
Arndt, Preston, Chapin, Lamp & Keen, Inc.

Gardner-Denver Company 34
The Buchen Company

Garrett Oil Tools, Inc 26
Glenn Mason, Cunningham & Associates

General Controls Company 107
Hixson & Jorgensen, Inc.

Geolograph Company 137
Lowe Runkle Company

Grove Valve & Regulator Company 22
L. C. Cole Company, Inc.

Gulf Oil Corporation 12-13
Ketchum, MacLeod & Grove, Inc.

Matthew Hall & Company Ltd. 9

Halliburton Company 38
Glenn Advertising, Inc.

Frederic R. Harris, Inc. 94, 108

Herb J. Hawthorne, Inc. 130
Robinson-Gerrard-McGary, Inc.

Hercules Tool Company 115
Keefe Advertising Agency

Hughes Tool Company 18-19
Foote, Cone & Belding

I.C.I. Heavy Organic Chemicals Div. 6, 85
Clifford Martin Ltd.

I.C.I. Billingham Div 88
Clifford Martin, Ltd.

International Harvester Export Co. 23
McCann-Erickson Corp. (International)

Jensen Bros. Mfg. Co. Inc. 128
Bryan & Bryan Advertising

M. W. Kellogg Company 77
Fuller & Smith & Ross Inc.

KLM Royal Dutch Airlines 116

LaCoste & Romberg 104
Marvin Gwinn & Associates, Inc.

Lake & Elliot Ltd. 128
Ripley, Preston & Co., Ltd.

H & E Lintott Ltd. 129
R. F. White & Son Ltd

The London Midland Steel Scaffolding Co. Ltd. 32
S. H. Wright & Co. Ltd.

The Lummus Company 2
G. M. Basford Company

M. A. N. 74
Linder Presse Union G.M.B.H.

Manning, Maxwell & Moore, Inc. 36
Fuller & Smith & Ross Inc.

The Mayo Hotel 108
Ferguson Miller Associates

McCullough Tool Company 93, 101
Raymond O. Perry, Advertising

Mercedes-Benz Diesel 61
Heumann Werbegesellschaft MBH

Mid-Continent Supply Company 62-63
Magnussen Advertising Agency

Newalls Insulation Co. Ltd. 133
Doig Advertising, Ltd.

Newman Hender & Co. Ltd. 89
Adams Bros. & Shardlow Ltd.

Perkins Engines Ltd. 135
Crane Publicity Ltd.

Petrolite Corporation 97
Batz-Hodgson-Neuwoehner Inc.

Pipe Line Technologists 122
Ullrich & Brown Advertising

Procon Inc. 131
Tobias, O'Neil & Gallay, Inc.

The Pyrene Company Ltd. 69
Nelson Advertising Service Ltd.

Renold Chains Ltd. 136

Rice Hotel 137
Ritchie Advertising Agency

Richardsons, Westgarth & Co. Ltd. 121
Notley Advertising Ltd.

Royal Netherlands Harbour Works Co. Ltd. 15

Ruston & Hornsby Ltd. 134
Industrial Publicity Service Ltd.

Sante Fe Drilling Company 124
Dozier Eastman & Company

Schlumberger Surenco 55
Rives, Dyke & Company

Security Engineering Div., One of the Dresser Industries 31
The McCarty Co. of Texas, Inc.

Albert Sempell Rheinsche Armaturen und Maschinenfabrik 29

Shell Oil Company 5
Kenyon & Eckhardt Inc.

Sydney Smith & Sons Ltd. 103
S. H. Wright & Company, Ltd.

Peter Spence & Sons, Ltd. 83
Holmwood Advertising Ltd.

Standard Oil Company of New Jersey 10
McCann-Erickson, Inc.

Stewart & Stevenson Services Inc. 127
Rives, Dyke & Company

Stewarts & Lloyds Ltd. 56
H. Raymond Morgan

J. Stone & Co. (Propellers) Ltd. 119

Stone & Webster Engineering Corporation 73
Harold Cabot & Co. Inc.

The Thornycroft Organization 117
Gould & Portmans Ltd.

Truck Trailer Supply Company Inc. 109
Paul F. Etrick & Associates

United States Steel Export Company 30
Batten, Barton, Durstine & Osborne, Inc.

Universal Oil Products Co. 70-71
Tobias, O'Neil & Gallay, Inc.

Universal Oil Products Co.—Products Dept. 91
Tobias, O'Neil & Gallay, Inc.

Voisin Restaurant 96
Daniel & Charles, Inc.

Warren Petroleum Corporation Cover II
Chapman Company

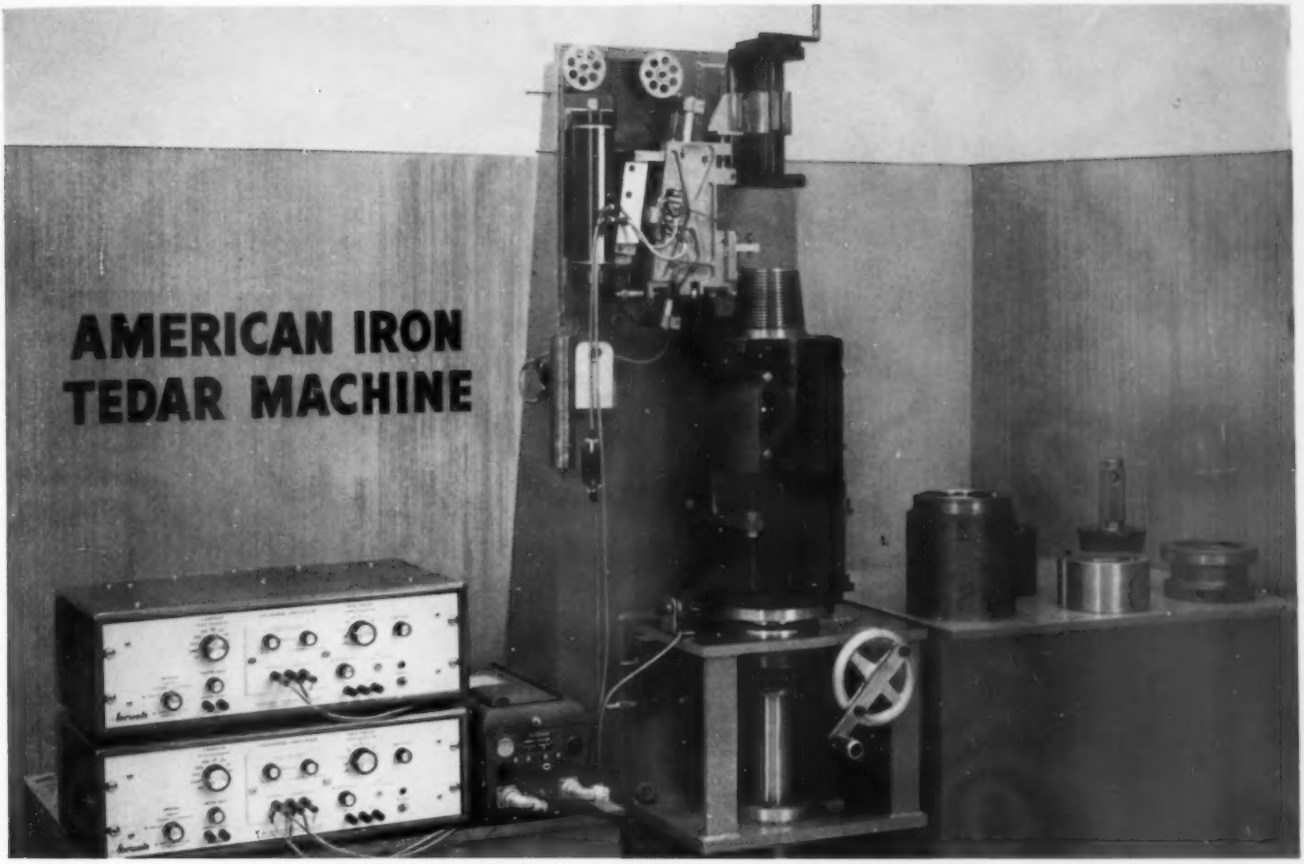
Werkspoor N. V. 120
Mark Fawdry Ltd.

Westinghouse Electric International Co. 110-111
Gotham-Vladimir Advertising, Inc.

The White Motor Co. Export Div. 123
Fuller & Smith & Ross Inc.

Williams Brothers 106
Ferguson-Miller Associates

Woodfield Rochester Ltd. 137
KS Advertising Ltd.



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